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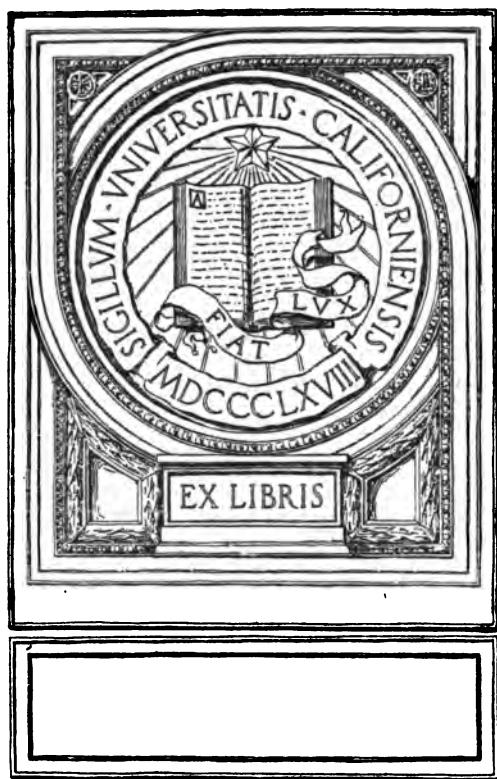
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THE IRON ORES OF LAKE SUPERIOR

CONTAINING SOME FACTS OF INTEREST RELATING
TO MINING AND SHIPPING OF THE ORE AND
LOCATION OF PRINCIPAL MINES

WITH ORIGINAL MAPS OF THE RANGES

BY

CROWELL & MURRAY
CHEMISTS AND METALLURGISTS

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TO WHOM
IT MAY COME



Preface

Much of the information contained in this book has appeared in the various trade journals, geological reports, and scientific society transactions.

Such widely scattered information, however, is of little practical use and our idea in presenting this book is that a compilation of such scattered facts would be appreciated by those interested in Lake Superior Ores.

In addition to this, we have secured the latest descriptions of most of the mines on the different ranges, and have worked out maps showing their exact location.

We are indebted to the various mine owners and ore sales agents for giving freely the information sought.

We shall be grateful for any criticisms, either as to statements or statistics, in which we may be in error, that such mistakes may be corrected in future editions of the book.

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Gogebic Range.	Marquette Range.
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HISTORY

The early history of the Lake Superior iron ore country has been carefully written up and it is not our purpose to go into the details of this very interesting subject.

In 1816 the United States government began its very careful survey of the government lands in the Northwest Territory. The system adopted was simple and is based on the well known method of determining points by rectangular co-ordinates, the original being the intersection of two lines run at right angles. One line extending North and South is called the principal meridian and the one extending East and West is called the base line. The land is then laid out in townships which are six miles square, and each designated by a number, North or South depending as to whether they are North or South of the base line. The lines running North and South dividing the townships are called range lines and the territory between two of these lines is known as the certain range number, East or West, as the case may be, from the principal meridian.

The townships are laid out in sections a mile square and are numbered from one to thirty-six, the numbers beginning at the North-east section, running West six numbers, East six numbers, then West six numbers, East six numbers, West six numbers, and East six numbers, and ending at the Southeast section.

Each section is divided into four parts and each part, containing 160 acres, is called a quarter section.

The first iron ore was discovered in Michigan in 1844 by a party of United States surveyors who, noticing the variations of their magnetic needle, found ore near Teal Lake.

The first iron made in the Lake Superior region was in an old forge on Carp River five miles East of Negaunee, February 10th, 1848. This forge was operated for several years, its largest production being three tons in one day.

The first shipment of ore from the Lake Superior region was made July 7, 1852, when 6 barrels of ore were sent to New Castle, Pennsylvania.

In 1855 the first ship canal around the rapids at Sault Ste. Marie was completed. In 1856 the Marquette Range began shipping regularly to the Lower Lake Ports.

The Menominee Range lies about fifty miles South of the Marquette Range. In 1873 the first ore was found on that Range, and in 1877 ore began to be sent out. The first actual cargo, however, was shipped from Milwaukee Nov. 11, 1884.

The Gogebic Range lies about 100 miles West of the Marquette Range. In 1883 ore in paying quantities was first found at the Colby Mine, and in 1886 this Range began to ship regularly.

Ore was discovered on the Vermillion Range at about the same time as on the Gogebic, and they both became shippers the same year, 1886. The Vermillion Range lies wholly in Minnesota, about 100 miles North of Duluth.

The Mesabi Range lies about thirty miles South-west of the Vermillion Range in the State of Minnesota. It began to ship ore in 1892, and owing to the large bodies of ore, and the ease with which it can be taken out, it has become the largest shipper of ore of any of the Ranges.

The Cuyuna Range, located about ninety miles West of Duluth, is the youngest iron ore range in the Lake Superior region.

In 1903, a low grade magnetite was discovered near Deerwood, Minnesota, and later hematite deposits were shown to exist. There has been considerable exploration work done on the Range since, and in 1911, it is expected that the Range will become a shipper of ore.

The Baraboo Range is located South of the central part of Wisconsin. Iron ore was first discovered in 1900 on this Range, and since 1904, the Range has been a regular shipper of ore.

The Michipicoten Range is, up to date, the largest shipper of ore in Canada. This Range is located on the Northern shore of Lake Superior, Northeast of Michipicoten Island. It was first opened up in 1897, as a gold mining district, but soon turned out to be far more valuable as an Iron Ore Range. The only shipping Mine is the Helen. This ore is used entirely in Canada.

The Moose Mountain Range is located about 30 miles North of Sudbury, in Ontario. It was first opened up in 1902. The only mine at present is the Moose Mountain, which began shipping in 1908.

GEOLOGY

The geology of the Lake Superior region is complex and the following is only an outline of the more important features in the various ore bearing districts.

The principal ore bearing districts are known as the Marquette, Crystal Falls, Menominee, Gogebic, Mesabi and Vermillion. Others of less importance are the Baraboo, Cuyuna, Michipicoten and the Moose Mountain districts.

The ore bearing districts comprise a very small part of the whole Lake Superior region. They have been closely studied and the more important geological features have been identified for each district. The intervening areas are not so well known.

The ores occur in iron formations which are contained in rocks of pre-Cambrian age. They are due to the chemical action of underground water which has acted on the iron formation and

caused a re-arrangement of their iron contents and the formation of ore bodies.

The iron formations occur in both the Archean and Algonkian divisions of the pre-Cambrian rocks. They are all very similar and consist of chert or quartz, ferric oxide and small amounts of other iron bearing rocks. They represent the alterations from chemically deposited sediments which were derived from rocks that were rich in iron. This alteration is due to the chemical action of underground water and is most extensive where conditions have been such as to favor the circulation of underground water. The most important feature in connection with the alteration of the iron formation and the production of iron ore deposits is the presence of a relatively impervious rock within or at the base of the iron formations. Where this impervious rock has assumed the form of a trough enclosing the iron formation the alteration is extensive and the ore deposits are large. Where the trough is small, irregular, or broken, the alteration is less extensive and the ore deposits are small.

The alteration of the iron formations and the concentration of their iron contents into ore bodies was probably far advanced in pre-Cambrian time, for fragments of ore and of iron formation are found in Cambrian sedimentary rocks.

The ore bearing districts are areas where the pre-Cambrian rocks are exposed. The oldest of these rocks, and probably the oldest rocks in the Lake Superior region are certain of the basic igneous rocks known as greenstones and green schists. Together with their associated slate and iron formation they are called Keewatin. Intrusive into these rocks and younger than they are, are certain Laurentian granites and gneisses.

The Keewatin and Laurentian rocks make up the Archean division, or Basement Complex of the pre-Cambrian rocks. The upper division or Algonkian system is made up of four sedimentary series which are closely associated with igneous rocks. The three lower series consist of iron formations interbedded with slate and quartzite and are known as the Lower, Middle and Upper Huronian. The upper series is known as the Keweenawan. It consists of basic and acid igneous rocks interbedded with sandstone and conglomerate. It contains no iron formation but forms the copper bearing series of Michigan.

The various iron formations are not all present and productive in any one locality. In the Vermillion and Michipicoten Districts, the productive formations are in the Keewatin division of the Archean. In the Mesabi, Gogebic and Menominee districts, the iron formations are a part of the Upper Huronian series. In the Marquette district two productive formations are present, one in the Middle Huronian and one in the Upper Huronian. In the Crystal Falls district the productive formations are in the Upper and Lower Huronian series.

The iron formations are all very similar, but the factors which have controlled the underground circulation of water vary in the different districts. In the Mesabi district the impervious troughs consist of layers of slate or paint rock which are within the iron formation, but they are probably not as important as the topographical relation of the iron formation or as the folds in the iron formation which have furnished channels for the underground water.

In all of the other districts the presence of impervious troughs seems to be the controlling factor in the deposition of ore bodies. In the Vermillion district these troughs are formed of greenstone which encloses the iron formation. In the Gogebic district the impervious troughs are formed by the intersection of diorite dikes and quartzite. In the Marquette district the impervious basement is formed by greenstone which is intrusive into the iron formation, or by slate at the bottom of the iron formation. In the Menominee district the impervious troughs are formed by dolomite underlying the iron formation or by layers of slate within the formation.

The ores were all deposited in a hydrated condition but have been partially dehydrated and vary in the different districts from hard to soft ores. The hard ores are dehydrated and may be classified as red, blue, and micaceous hematite, magnetite and martite. The soft ores are limonite and hematite which is partially hydrated.

With very few exceptions the ore deposits lie either on the slopes or at the foot of conspicuous ranges or hills and it is believed that the present topographic features are the same as when the ore bodies were deposited. This relation is especially important in the Mesabi district and accounts for the formation of the ore bodies.

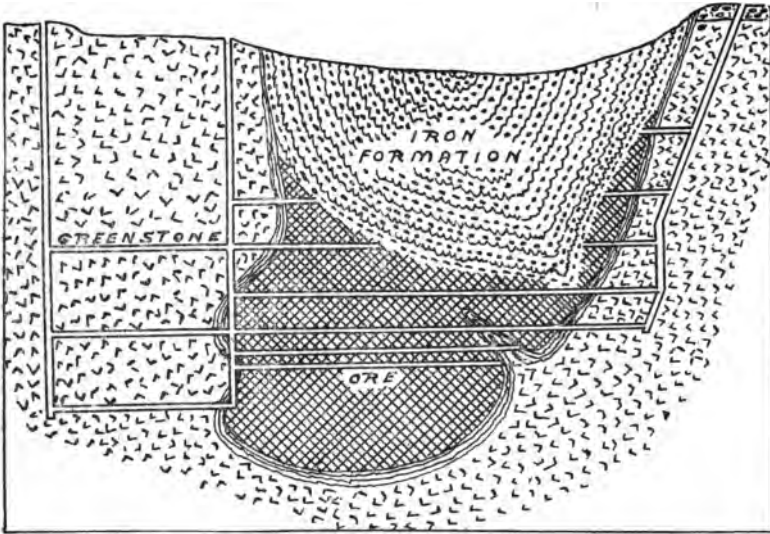
VERMILLION RANGE.

The Vermillion District lies in Northern Minnesota and includes the towns of Tower, Soudan and Ely.

The productive formation is the Soudan in the Keewatin division of the Archean. It occurs in narrow belts which are enclosed in greenstone. The whole district is one of complex folding. The ores are entirely hard blue and red hematites. They occur at or near the contact of the Soudan formation with the greenstone, and owing to the steep pitch the outcrops are small.

The depths of some of the mines are as follows:

Chandler 900 feet; Pioneer 1,261 feet; Savoy 857 feet; Sibley 1,281 feet; Soudan 1,249 feet; Zenith, 1,100 feet.

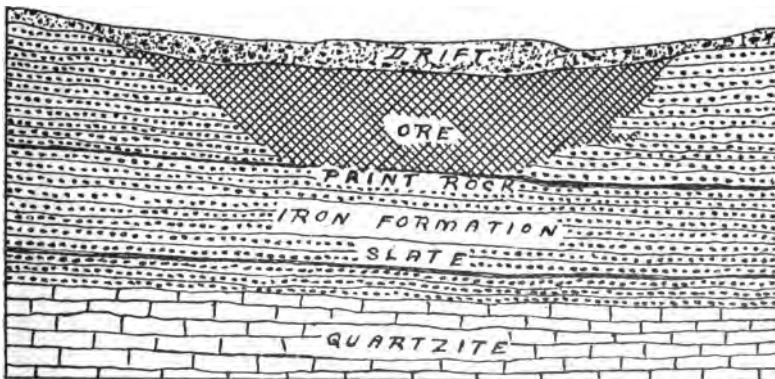


Vertical Section through Vermillion Ore Deposit and Adjacent Rocks;
Chandler Mine, Ely, Minn.

MESABI RANGE.

The Mesabi District is Northwest of Lake Superior. It lies wholly in the State of Minnesota, and extends approximately 100 miles in an East and West direction. The principal towns are Biwabik, Sparta, Eveleth, Virginia, Mountain Iron, Hibbing, Nashwauk and Coleraine.

The iron formation is the Biwabik in the Upper Huronian. It lies along the Southern slope of a ridge which is known as the



Generalized Vertical Section through Mesabi Ore Deposit
and Adjacent Rocks.

Giants or Mesabi Range and has a gentle slope towards the South. At about the center of the District, near Virginia, Eveleth and Sparta, the formation takes a relatively sharp bend, which is locally known as "The Horn." Transverse to the general trend of the iron formation are a series of folds, which have been the chief factors in the formation of ore bodies.

The slope of the iron formation is gentle and the ore deposits have a very gentle pitch as compared with the ore bodies in the other districts. While there is seldom any surface indications of ore, the ore bodies have great horizontal area and are usually covered with so little drift that the common method of the district is to strip off the drift and load the ore to the cars with steam-shovels.

The ores are mostly soft, hydrated hematite, although some limonite is found. They vary in texture from very fine dust to fairly coarse, hard and granular ore. Towards the Western end of the district, layers of sand are often found interbedded with the ore, forming the so-called "sandy" ores which will have to be concentrated to form ore of commercial grade.

The Mesabi ore deposits are shallow. The depths of some of the mines are as follows:

Mahoning 125 feet; Minorca 86 feet; Albany 190 feet; Shenango 250 feet; Virginia 341 feet; Susquehanna 192 feet.

GOGEBIC RANGE.

The Gogebic District is a narrow belt South of Lake Superior which lies in Michigan and Wisconsin. The most important part of the District lies in Michigan, although about two-thirds of the formation extends into Wisconsin. The most important towns are Hurley, Ironwood and Bessemer.

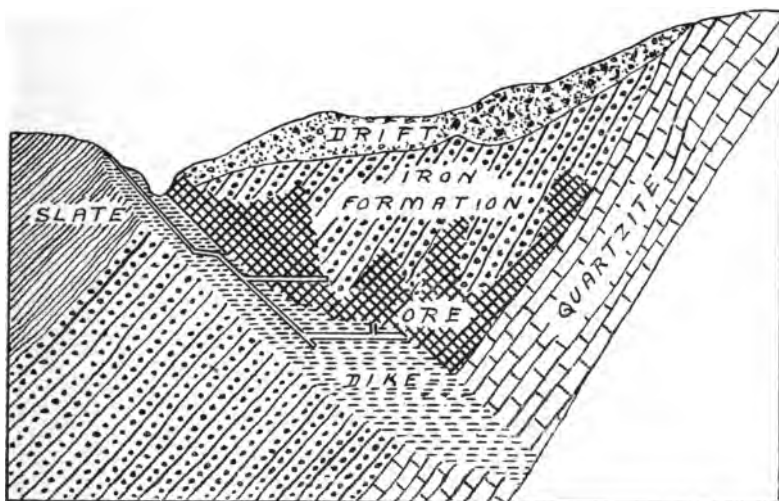
The productive formation is the Ironwood in the Upper Huronian series. It occurs as a narrow belt which dips towards the North and has a crenulated outcrop due to a series of minor transverse rolls.

The formation rests on Upper Huronian quartzite and is cut by igneous dikes which combine with the quartzite to form impervious troughs in which the ore bodies were concentrated.

The ores are soft, red and partially hydrated hematites, with subordinate amounts of hard, blue hematite.

The depths of some of the mines are as follows:

Ashland 1,324 feet; Norrie-Aurora 1,670 feet; Newport 2,200 feet; Ottawa 632 feet; Montreal 1,900 feet; Yale 1,780 feet.

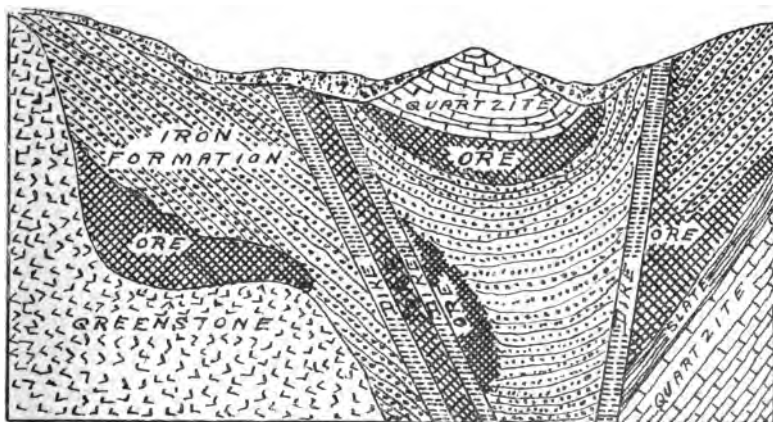


Generalized Vertical Section through Gogebic Ore Deposit
and Adjacent Rocks.

MARQUETTE RANGE.

The Marquette District is comparatively small. It lies in the State of Michigan and gets its name from the city of Marquette. The principal towns are Marquette, Ishpeming, Negaunee, Champion and Republic.

The iron formations occur in the Upper and Middle Huronian and the Keewatin division of the Archean. The productive forma-



Generalized Vertical Section through Marquette Ore Deposit
and Adjacent Rocks.

tions are the Negaunee in the Middle Huronian and the Ishpeming in the Upper Huronian.

The ores are mostly soft, red hematites although the hard micaceous hematites are important. Subordinate amounts of magnetite and limonite are found.

The district is cross folded so that the formations are irregularly distributed. In general the iron formation extends in an East and West direction, and the portions of the ore deposits that reach the surface are located on the middle or upper parts of the slopes. The outcrops of ore were conspicuous and led to the early discovery of this district. Some of the bodies are entirely below low lying areas, but in those cases are surrounded by impervious rocks.

The depths of some of the mines are as follows:

American 850 feet; Angeline 515 feet; Champion 2,292 feet; Hartford 1,075 feet; Princeton 383 feet; Republic 1,950 feet; Washington 572 feet.

MENOMINEE RANGE.

The Menominee District includes the towns of Iron Mountain, Quinnesec, Norway, Vulcan and Waucedah. It lies wholly in the State of Michigan.

The productive iron formation is the Vulcan in the Upper Huronian series. It occurs in several narrow belts, all of which have a steep dip. The principal belt extends about twenty miles in an East and West direction. The formation, where productive, rests on the Lower Huronian dolomite and is covered by Upper Huronian slate. The Middle Huronian series has not been identified in the district.

The ores are mostly gray banded hematites, though subordinate amounts of silicious black and gray banded hematite are found.

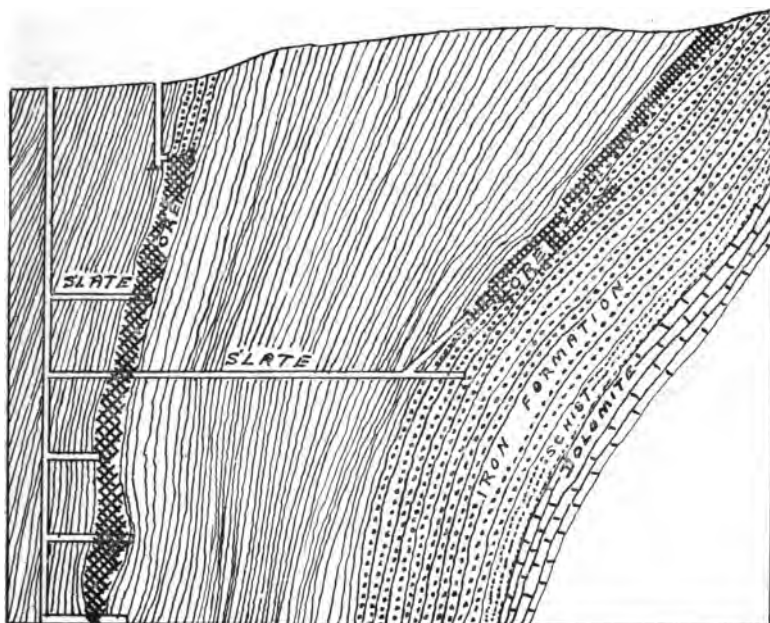
The depths of some of the mines are as follows:

Breen 258 feet; Chapin 1,522 feet; East Vulcan 1,400 feet; Loretto 800 feet; Millie 600 feet; Pewabic 941 feet; West Vulcan, Curry and Briar Hill 1,500 feet.

CRYSTAL FALLS DISTRICT.

The Crystal Falls District contains a greater area than any of the other ore bearing districts. The greater part of the district lies in Michigan and the remainder in Wisconsin. The principal towns are Florence, Commonwealth, Mansfield, Crystal Falls, Amasa and Iron River.

The iron bearing formations occur in the Upper and Middle Huronian, and are respectively known as the Michigamme and the Negaunee formations. The ores are mostly soft, red hematite, although in places they are hydrated and classed as limonite.



Generalized Vertical Section through Menominee Ore Deposit and Adjacent Rocks.

The district includes the Metropolitan, Commonwealth, Florence and Iron River areas. It is usually included with the Menominee district in the figures for the production of iron ore.

The structural geology is complicated and no effort is made to give an outline of it.

The depths of some of the mines are as follows:

Bristol 900 feet; Baltic 553 feet; Florence 700 feet; Hemlock 935 feet; Hiawatha 665 feet; Hollister 500 feet; Mansfield 1,189 feet.

BARABOO DISTRICT.

The Baraboo District is an outlier of the Lake Superior pre-Cambrian rocks which is found in South central Wisconsin. The principal town is North Freedom.

The iron formation is similar to the Middle Huronian but has not been positively identified. The ores are hematite with soft earthy, hard and black, and banded silicious phases. They are stratified and have the same strike and dip as the associated rocks which are found dipping at various angles from nearly horizontal to nearly vertical.

The depth of the Illinois Mine is 475 feet.

CUYUNA RANGE.

The Cuyuna Range is located in Crow Wing County in North Central Minnesota. The principal towns are Deerwood, Brainerd and Aitkin.

The iron formation occurs in two belts which have a general Northeast and Southwest direction. It has not been definitely identified and may belong to the Archean Middle Huronian or Upper Huronian age.

MICHIPICOTEN DISTRICT.

The Michipicoten District lies in Canada on the Northeast shore of Lake Superior. The only productive mine is the Helen which is situated twelve miles from Michipicoten Harbor.

The iron formation is practically equivalent to that in the Vermillion District and is found in the Keewatin division of the Archean. The ore is a mixture of hematite and limonite and originally extended in considerable areas to the rock surface. The present depth of the mine is 480 feet.

MOOSE MOUNTAIN DISTRICT.

The Moose Mountain District is located in Canada. Only one mine is productive. It is twenty-five miles North of Sudbury and is eighty miles by rail from Key Harbor on Georgian Bay.

The ore occurs in the Keewatin division of the Archean. It is mostly finely crystallized magnetite, although it contains a little hematite. It varies from high-grade ore to material which it is necessary to concentrate. The ore is mined by open cut.

MINERALOGY

The minerals described are:

Oxides	Hematite, Fe_2O_3	Hexagonal
	Martite, Fe_2O_3	Isometric
	Magnetite, Fe_3O_4	Isometric
	Ilmenite, $(\text{Fe Ti})_2\text{O}_3$	Hexagonal
Hydroxides	Limonite, $\text{Fe}_2(\text{OH})_6\text{Fe}_2\text{O}_3$	
	Turgite, $\text{Fe}_4\text{O}_5(\text{OH})_2$	
	Goethite, $\text{Fe O}(\text{OH})$	Orthorhombic
Carbonate	Siderite, Fe CO_3	Hexagonal
Sulphides	Pyrite, Fe S_2	Isometric
	Pyrrhotite, Fe_8S_7 to $\text{Fe}_{11}\text{S}_{12}$	Hexagonal
	Marcasite, Fe S_2	Orthorhombic

The principal iron ores are hematite, limonite, magnetite and siderite. Turgite and goethite are commercially included with limonite. The residues from roasting the sulphides for sulphuric

acid manufacture are sometimes used as a source of iron, and some ilmenite is smelted with other ores.

HEMATITE.

Composition: Fe_2O_3 contains 70.00% iron.

Description: Occurs in masses which are compact, granular, or sometimes micaceous and as loose pulverulent earth. It varies in color from brilliant black metallic to brick red. In all varieties the streak on porcelain is red. The hardness varies from 5.5 to 6.5 and the specific gravity from 4.9 to 5.3.

MARTITE.

Composition: Fe_2O_3 contains 70.00% iron.

Description: Differs from hematite in nothing but form. It occurs in octahedrons which it is supposed were derived from the oxidation of magnetite.

MAGNETITE.

Composition: Fe_3O_4 contains 72.4% iron.

Description: A black mineral with a black streak on porcelain, and metallic lustre, strongly attracted by the magnet and occurring in all conditions from loose sand to compact coarse or fine grained masses. The hardness varies from 5.5 to 6.5 and the specific gravity from 4.9 to 5.2.

ILMENITE (Iron Titanium Compound).

Composition: $(\text{Fe Ti})_2\text{O}_3$, composition variable.

Description: An iron black mineral usually massive, and in thin plates, imbedded grains, or as sand. The streak on porcelain is black to brownish red. The hardness varies from 5 to 6 and the specific gravity from 4.5 to 5.

LIMONITE.

Composition: $\text{Fe}_2(\text{OH})_2\text{Fe}_2\text{O}_3$ contains 59.8% iron.

Description: Varies from loose porous bog ore and ochre to compact varieties which often have a black varnish like surface and a fibrous radiated structure. It is recognized principally by its yellowish brown streak on porcelain and absence of crystallization. The hardness varies from 5 to 5.5 and the specific gravity from 3.6 to 4.

TURGITE.

Composition: $\text{Fe}_4\text{O}_5(\text{OH})_2$ contains 66.2% iron.

Description: Nearly black and resembles limonite but has a brownish red streak on porcelain. The hardness varies from 5.5 to 6 and the specific gravity from 4.3 to 4.7.

GOETHITE.

Composition: $\text{FeO}(\text{OH})$ contains 62.9% iron.

Description: A yellow, red, or brown mineral occurring in distinct crystals often flattened, like scales, or needle like and grouped in parallel position; also occurs massive like yellow ochre. The streak on porcelain is yellow, or brownish yellow. The hardness varies from 5 to 5.5 and the specific gravity from 4 to 4.4.

SIDERITE.

Composition: FeCO_3 contains 62.1% iron.

Description: Occurs in granular masses of a gray or brown color, or may be black from included carbonaceous matter. The lustre is vitreous to pearly and the mineral is brittle. The streak on porcelain is white or pale yellow. The hardness is 3.5 to 4 and the specific gravity 3.8 to 3.9.

PYRITE.

Composition: FeS_2 contains 46.7% iron, 53.3% sulphur.

Description: A brass colored metallic mineral frequently in cubic or other isometric crystals, or in crystalline masses; less frequently in non crystalline masses. The streak on porcelain is greenish black, the hardness 6 to 6.5 and the specific gravity 4.9 to 5.2.

PYRRHOTITE.

Composition: Fe_8S_7 to $\text{Fe}_{11}\text{S}_{12}$, composition variable.

Description: Usually a massive bronze metallic mineral which is attracted by the magnet and can be scratched with a knife. The streak on porcelain is grayish black, the hardness 3.5 to 4.5 and the specific gravity 4.5 to 4.6.

MARCASITE.

Composition: FeS_2 . Same as pyrite.

Description: Differs from pyrite in nothing but form. Crystallizes in orthorhombic forms which have received the names of cockscomb pyrites, spear pyrites, etc. The streak on porcelain is nearly black, the hardness 6 to 6.5 and the specific gravity 4.6 to 4.9.

MINING METHODS

The mining methods of the Lake Superior region combine the use of the most efficient mechanical appliances with great natural advantages as to the size and purity of the ore bodies.

The natural result is that a maximum of ore is mined at a minimum expense.

The ore comes from a great many different mines, and individual mines show great variations as to the character and accessibility of the ore. In some cases the ore is extremely hard and difficult to mine, and in other cases it is very soft. In some cases it occurs in great beds which are covered only with glacial drift and can be mined from the surface, and in other cases it occurs at great depths and must be mined by underground methods. In any case, preliminary explorations allow the use of carefully planned systems, and the mining methods are cheap and effective.

At the present time, approximately two-thirds of the Lake Superior ore comes from the Mesabi range, due to the ease with which the Mesabi ores are mined. The ores are soft and friable and occur in shallow troughs which have a large horizontal area. In most cases they are covered only with glacial drift which varies in thickness from a few feet to a hundred feet or more.

The characteristic method of mining, on the Mesabi range, is to remove the glacial drift which covers the ore, and load the ore into railroad cars with steam shovels. This method is followed wherever conditions will permit, but a large portion of the Mesabi ores are mined by underground methods, known as caving and slicing systems, and a small portion is mined by a combination of surface and underground methods known as the milling system.

The method of mining on the Mesabi range is determined by the thickness of the covering over the ore, the size and form of the ore body, the facilities for approaching the ore, the available space for dumping the over-burden, and the capital available for stripping. These factors are determined previous to actual mining, and the propriety of mining in open pits or underground is established.

Where the conditions are favorable and the over-burden and ore are soft and uniform, it has been found economical to mine the ore by surface methods. The system varies in different mines. In some cases the tracks are laid down in the form of a spiral, with the lowest part in the center of the pit, and in other cases they are laid down on the various ore benches and converge to a common approach. In some cases, it has been economical to remove four or five tons of over-burden for every ton of ore in the deposit, and the pits vary in depth from 75 to 150 feet. In no case is it necessary to use cables to haul the loaded cars to the main track.

Where the conditions are less favorable, underground methods are resorted to and a large portion of the Mesabi ores are mined by the caving and slicing systems. The caving system consists

in taking the ore from a series of levels connected with the main shaft which is usually located in the wall rock. The ore is taken from the upper levels, and delivered by chutes to the lower levels, which are securely protected. As the ore is removed from the upper levels, the roof is allowed to settle upon the ore below and the process is repeated until the bottom of the deposit is reached.

The slicing system is employed where there is a series of drifts, one advanced more than the other, so that the ore in the deposit is sliced off.

The milling system of mining is used for a small portion of the Mesabi ores. The over-burden is removed as in open pit mining, but instead of loading the ore into cars, it is broken into raises or mills which extend from underground workings to the surface of the ore. The ore is then transported to the shaft, which is usually placed in the wall rock, and is hoisted as in other underground methods.

On the other ranges the ores occur at greater depths and underground methods are generally used. In some cases the mine workings extend to a depth of 2000 feet and are still in ore, but in general, the ore is hoisted from depths that vary from 500 to 1500 feet. In some cases, the ore is soft and is capable of caving; in other cases it is hard and the caving system cannot be adopted. In some cases the ore is intermediate between hard and soft, and a combination of a caving system with some other method is necessary.

Where the ore is soft, a caving system is used. A shaft is sunk and haulage ways, as far as possible, are made in the solid rock. Raises are then driven to the top of the ore deposit and cribbed with two compartments, one for a ladder road and the other for the ore. The raises are spaced at intervals from 60 to 100 feet and sublevels are made to facilitate operations. When the raises are completed drifts are run parallel with the deposit and timbered with square sets; cross cuts are driven to both foot and hanging walls and the whole top of the ore body is drawn into the raises. The floor is then covered with planks and the timbers are blasted out so that the over-burden over the whole area is lowered. The process is then repeated with the exception that the over-burden is lowered after each slice is taken out, until the bottom of the deposit is reached.

Where the ore is hard and occurs in a narrow body which is steeply tilted, it is mined from a series of levels which connect with the shaft which is placed in the wall rock. When the ore is mined above a given level and is allowed to fall by gravity through chutes, or otherwise, it is known as overhand stoping. Where it is mined below a certain level and is raised to the level it is called underhand stoping. In most cases, the first named

method is the most advantageous. The workings are usually filled with waste rock in preference to maintaining timber.

Where the ore is intermediate between hard and soft, and occurs in a large body, a system is used that starts out as a square set system and develops a caving system as the work progresses. The shaft and haulage ways, as far as possible, are placed in the solid rock and the whole deposit is honeycombed, pillars of ore and rooms alternating on each level. The rooms are timbered with good substantial square set timbers. After the rooms are finished the pillars are removed. An upraise is run up through the center of each pillar and timbered with the usual sets and the ore is broken down from the top and sent down the chutes in the outside sets. When the pillars have all been removed the timbers are blasted out, and the roof over the whole area is lowered.

A system called "scramming" is used on the levels below. Each level is divided into fifty foot squares, and in each square an upraise is run to the top of the ore. Drifts are then run each way from the bottom of the raise and the top of the square drawn into the raise. In this way the roof is allowed to settle over the whole square, and the process is repeated until all of the ore is mined.

TRANSPORTATION

The Lake Superior Iron Ores are carried by rail from the mines to the various loading docks on the Upper Lakes. The ore is moved to the Lower Lakes entirely by boat.

The first shipment of ore down the Lakes was in 1852, and consisted of five barrels of ore.

The largest cargo in 1856 was 400 tons; ten years later in 1866 the largest cargo was 697 tons; in 1876 the largest cargo was 1360 tons; and in 1886, 2450 tons were shipped in one vessel. In 1886 the first steel steamer, the "Spokane," 310 feet long, came out. The size of the cargoes gradually increased until 1895. During this year the first 400-foot boat, the "Auronia," came out and the largest cargo carried was 3,843 tons. In 1900 the first 500-foot boat came out and the size of the largest cargo was 7,450 tons. During the last ten years the size of the largest carriers has increased to over 600 feet, and in 1910 the largest cargo brought down the Lakes was 13,410 tons.

The unloading at the Lower Lake Ports is done by several types of unloading machines, and the ore is placed either directly on cars or on stockpiles for future shipments. At furnace plants located directly on the Lakes, the ore is unloaded from the boat directly on the Furnace stockpile. Ore for furnaces inland is moved by rail from the Lake Ports.

Rail Freights on Iron Ore from the Mines to Lake Shipping Points										
Year	Marquette Range		Menominee Range Escanaba	Gogebic Range Ashland		Mesabi and Vermilion Ranges To Two Harbors From				
	Marquette	Escanaba		Wis. Cent. R. R.	C. & N. W. R. R.	Duluth	Superior	Ely	Tower Soudarn	Other Points
1855	\$3.00									
1856	1.27									
1857	1.27									
1858	.87									
1859	.87									
1860	1.09									
1861	1.09									
1862	1.09									
1863	1.09									
1864	1.09									
1865	1.10									
1866	1.10	\$1.55								
1867	1.10	1.80								
1868	1.10	1.80								
1869	1.10	1.85								
1870	1.10	1.85								
1871	.95	1.70								
1872	.84	1.70								
1873	.84	2.00								
1874	.84	2.00								
1875	.65	1.25								
1876	.55	1.15								
1877	.55	1.15								
1878	.55	1.15								
1879	.55	1.15								
1880	.55	1.25								
1881	.55	1.25								
1882	.55	1.25								
1883	.55	1.10								
1884	.40	.80								
1885	.45	.80								
1886	.55	.80								
1887	.55	.80	\$0.85	\$0.80	\$0.80					
1888	.45	.70	.75	.70	.70					
1889	.45	.70	.75	.70	.70					
1890	.45	.70	....	.70	....				
1891	.45	.70	.70	.65	.65					
1892	.40	.65	.70	.65	.65	\$0.80	\$0.80	\$1.00	\$0.90	\$0.80
1893	.40	.65	.70	.65	.65	.80	.80	1.00	.90	.80
1894	.32	.52	.70	.52	.65	.80	.80	1.00	.90	.80
1895	.32	.52	.52	.52	.52	.80	.80	1.00	.90	.80
1896	.32	.52	.52	.52	.52	.80	.80	1.00	.90	.80
1897	.32	.52	.52	.45	.52	.80	.80	1.00	.90	.80
1898	.32	.40	.45	.40	.45	.80	.80	1.00	.90	.80
1899	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1900	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1901	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1902	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1903	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1904	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1905	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1906	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1907	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1908	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1909	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80

Lake Freight Rates on Iron Ore from Ports Named to Lake Erie

YEAR	ESCANABA	MARQUETTE	ASHLAND AND OTHER PORTS AT HEAD OF LAKE SUPERIOR
1855.....		\$3.00	
1856.....		3.00	
1857.....		2.67	
1858.....		2.09	
1859.....		2.00	
1860.....		2.00	
1861.....		2.21	
1862.....		2.89	
1863.....		3.19	
1864.....		3.37	
1865.....		3.23	
1866.....	\$3.77	4.17	
1867.....	3.28	2.98	
1868.....	2.44	3.11	
1869.....	2.43	3.21	
1870.....	2.40	3.06	
1871.....	2.07	2.83	
1872.....	2.50	3.59	
1873.....	2.74	3.44	
1874.....	No shipment	3.84	
1875.....	No shipment	2.87	
1876.....	No shipment	2.54	
1877.....	No shipment	1.40	
1878.....	.85	1.26	
1879.....	1.07	1.61	
1880.....	1.77	2.50	
1881.....	1.55	2.25	
1882.....	1.22	1.50	
1883.....	1.11	1.30	
1884.....	.98	1.21	
1885.....	.84	1.01	\$1.20
1886.....	1.16	1.35	1.49
1887.....	1.49	1.75	2.11
1888.....	.97	1.22	1.34
1889.....	1.00	1.14	1.29
1890.....	.99	1.16	1.26
1891.....	.74	.96	1.05
1892.....	.87	1.06	1.20
1893.....	.70	.85	.88
1894.....	.53	.70	.79
1895.....	.64	.83	.96
1896.....	.61	.80	.91
1897.....	.45	.60	.63
1898.....	.48	.60	.61
1899.....	.72	.84	.95
1900.....	.85	.94	1.05
1901.....	.62	.74	.84
1902.....	.59	.68	.76
1903.....	.63	.73	.83
1904.....	.54	.61	.70
1905.....	.60	.70	.76
1906.....	.60	.70	.75
1907.....	.60	.70	.75
1908.....	.50	.60	.65
1909.....	.50	.60	.65
1910.....	.50	.60	.65

The cost of transporting the ore from the mines to the Lower Lake Ports includes the charge on the rail shipments from the mine to the dock and the charge on the boat shipment from the dock to the Lower Lake Ports.

The rail freight from the Marquette Range to Marquette in 1855 was \$3.00 per ton. In 1866 Marquette Range ore also began to be shipped to Escanaba. The freight rate was \$1.55 per ton. These rates were gradually reduced till 1899, when the rate to Marquette was 25 cts. per ton, and to Escanaba 40 cts. per ton. These rates were in force until 1905, when the Marquette rate was raised to 32 cts., the Escanaba rate remaining at 40 cts. These last rates are still in force.

The first freight rate for Menominee ore to Escanaba was 85 cts. per ton. This was in 1887. The rate was gradually reduced until 1899, when the present rate, 40 cts. per ton, went into effect.

In 1877, the rate from the Gogebic Range to Ashland was established at 80 cts. per ton. This was gradually reduced until 1898 when the present rate of 40 cts. per ton was established.

In 1892, the rates from the Vermillion and Mesabi Ranges were established as follows: Mesabi Range to Duluth 80 cts. per ton, to Superior 80 cts. per ton, to Two Harbors 80 cts. per ton, from Ely to Two Harbors \$1.00 per ton, from Tower and Soudan to Two Harbors 90 cts. per ton. These rates have remained the same up to date.

CLASSIFICATION OF ORES

In the early days of iron ore mining and up to within a comparatively few years, the ore from a certain mine was quite uniform in composition. The ore was known by the name of the mine which produced it, and the user of a particular ore one year, could be sure that the ore would be of the same composition the next year, and buy accordingly.

As the production increased from year to year, in order to supply the demand it became necessary to grade ores from the same mine according to their composition; and further, to mix ores from different mines to produce an ore of a certain composition. At the present time it is quite customary to ship several differently named ores from the same mine, and a mixture of ores from different mines under a particular name.

As soon as the above condition was brought about, it at once became necessary for the user to know the exact composition of the various ores, and to be certain, that in the case of a mixed ore, each cargo was or was not, up to grade.

The successful operation of a blast furnace depends largely on keeping the conditions, under which it is running, constant.

These conditions are varied and many, and one of the principal ones is a regular burden of ore. At the beginning of the year the furnaceman figures out his requirements, using the analyses as guaranteed by the sellers of the various ores. He figures what limestone and coke he will require to flux the particular ores he is to use, and how much his pig iron will cost.

If, when the ore begins to come in, the analysis varies from what the furnaceman has calculated, it means trouble all around. He must increase or decrease the amount of coke and limestone used, he must raise or lower the blast temperature, and perhaps finally, not be able to make the grade of pig iron which he expected to.

Briefly, the chemical reactions in a blast furnace are first, the formation of the gas, carbon monoxide, (CO) from the oxygen of the air and the carbon of the coke. This gas, coming in contact with ore, takes up oxygen from the ore, forming Carbonic Acid (CO₂) and leaving metallic iron behind.

The carbonic acid then comes in contact with more coke and is reduced again to carbon monoxide, which in turn again coming in contact with more ore, takes oxygen, again forming Carbonic Acid, leaving behind metallic iron. During these oxidizing and reducing reactions the impurities of the ore, namely: silica, alumina, lime, magnesia, phosphorus, manganese and sulphur are being formed into a slag through the presence of the limestone and intense heat. The slag being lighter in weight than the liquid iron, stays on top of the iron and is drawn off from the furnace through a tapping hole. The liquid iron is run off through a hole in the furnace.

Unfortunately all the impurities do not stay in the slag. Practically all of the phosphorus, quite a considerable amount of the sulphur, about three-quarters of the manganese, and more or less silicon, reduced from the silica, goes into the iron. All the alumina, lime and magnesia of the ore stay in the slag. Lime and magnesia to a certain extent, are desirable constituents of iron ores, because in using such ores in a blast furnace, less limestone is required to form a slag. Alumina is not so desirable. A small amount of manganese does no harm in an ore, the less sulphur the better, and the amount of phosphorus determines whether the ore is Bessemer or Non-Bessemer.

Strictly speaking, a Bessemer ore is one in which the phosphorus is low enough to make Bessemer iron, which latter is supposed to contain not over .100% phosphorus. Hence, theoretically, the maximum allowable phosphorus in a Bessemer ore, depends on the iron. A common way of expressing this is, that the numerical figures of the dry phosphorus percentage must not exceed the numerical figures of the dry iron percentage, that is, if the dry iron in an ore is 55%, the phosphorus should not exceed .055%. The phosphorus in a Bessemer ore may vary widely but

it is generally accepted in the trade that the maximum must not be over .060%.

All iron ore contains a certain amount of moisture as it comes from the ground. As the ore is unloaded at the furnace, this moisture will be more or less than it was at the mine, depending on whether it has been subjected to drying or wetting conditions.

Before the chemist determines the iron or any other constituent, the ore is dried at 100° C. which is the same as 212° F. This drying, of course, removes all the moisture from the ore, except that which is chemically combined. This is done in order that the sample shall be in a uniform physical state. If the ore was not dried two chemists would probably not be able to get the same results. For instance, in determining iron they would not have the same amount of ore in the weight taken because of more or less moisture present.

The furnaceman, however, is not so much interested in the "dry" analysis, because when the ore is weighed into the furnace, it contains more or less moisture. This is the reason why analyses are reported in both the "dry" and "natural" conditions. The "natural" represents the iron in the ore in the condition in which it was sampled. This "natural" analysis, of course, is a calculated one. For instance, the dry analysis shows the iron to be 60%, and the moisture 10%; subtracting the percentage of moisture from 100%, and multiplying the remainder by the "dry" iron, we have 54%, which is the "natural" iron in the ore. The same method of procedure gives the natural analysis of the other constituents of the ore, and in calculating a burden for a blast furnace, the natural analysis is used.

SAMPLING

In the very early days of iron ore industry, the sampling of the ore received very scant attention. The ore seller had samples of the ore in his office with their analysis, and the ore was bought for so much per ton, with the idea that the analysis of the ore bought would be the same as that of the sample in the sellers office.

After a time it was found that this analysis was not always the same and the seller was obliged to guarantee something. He then guaranteed that the iron in the ore dried at 212° F, would be a certain percentage. These guarantees did not always materialize and it soon became the custom to divide the selling price by the guarantee, which gave a unit value, and from an average analysis of the buyer and seller, to pay for the ore on this unit basis.

After the soft iron ores came into the market, the question of moisture became prominent, and the guarantees were adjusted according to the iron in the natural condition, instead of in the dry ore. The same method of finding the unit value was carried out, and payment for the iron was made on this unit value.

Iron ore is now bought and sold almost exclusively on the sampling and analysis of an Independent Chemist. Each cargo is sampled separately, and the average of the cargo analyses is used as a basis of settlement for the shipment.

There is probably nothing in connection with the handling of iron ore, which has been subject to more disputes, than the question of sampling. Much has been written about this matter and it has been clearly demonstrated that the subject is an extremely complicated one, and one in which higher mathematics is necessary to fully demonstrate.

The sampling of iron ore cargoes must necessarily be done by a class of men not familiar with higher mathematics, and as a rule, not capable at all times, of exercising proper judgment as to the lump and fine, wet and dry ore.

An error in analysis can be detected by redeterminations, but after the sample is once taken, it must stand right or wrong.

We do a large amount of this work and have given the question of sampling very careful consideration. It is our opinion, that the less left to the judgment of the sampler, the better. In other words, the nearer we can approach a mechanical sample, the more liable we are to get a correct average of the ore.

It is obvious that were we able to grind up a whole cargo, thoroughly mix and properly quarter, we could finally have left a small pile of ore representing accurately this particular cargo. Such a method of procedure not being practical, the question arises, how can we best approach this ideal condition.

After much thought and investigation, the following method of sampling has been adopted; and is now used by all the Independent Chemists of Cleveland.

SAMPLING METHOD

STANDARD METHOD FOR SAMPLING CARGOES OF IRON ORE AT LOWER LAKE PORTS.

A continuous sample shall be taken from all cargoes, the weight of the sample varying with the size of the cargo.

This sample shall be taken with a galvanized iron scoop $3\frac{1}{2}$ " wide, $2\frac{1}{4}$ " long and $1\frac{1}{4}$ " deep, the handle 8" long; and with a hammer 12" long (the scoop holds approximately $\frac{1}{2}$ pound).

It shall be the aim to take an equal bulk of ore from every point selected. When a lump is encountered a portion shall be

broken off equal in bulk to a scoopful of soft ore. In sampling cargoes no sample shall be taken from the original outside surfaces on account of the presence of foreign matter and an undue proportion of fines.

SAMPLING OF SOFT ORE.

The sampler shall enter any hatch and begin sampling when the unloading machines have exposed five or six feet of the face.

In order to keep the size of samples within reasonable bounds and to gauge this size to the size of the boat, the sampler shall on cargoes up to 3500 tons, begin sampling at a convenient point at the bottom of the face of the ore, and shall take one standard scoopful every two scoop lengths up the face of the ore to the top, and then shall move four scoop lengths to one side of the starting point before again sampling vertically. He shall continue in this manner keeping the above distances around the face of the ore to the place of beginning.

On cargoes from 3500 to 6000 tons, he shall use the two scoop lengths for vertical distances up the face of the ore, but move six scoop lengths horizontally.

On cargoes over 6000 tons, he shall use the two scoop lengths for vertical distances up the face of the ore, but move eight scoop lengths horizontally.

The sampler shall then enter the next hatch working, and proceed to sample in exactly the same way, and so continue in every hatch.

The sampler shall then begin over again in the hatch in which he first started and continue the sampling in all the hatches provided there has been sufficient ore removed in the hatches since the faces were sampled to expose fresh ore.

The sampler shall continue this method of sampling in each hatch worked, until there is less than one-tenth of the ore left.

In sampling horizontal surfaces, as in boats where scrapers are used, the sampler shall sample every two scoop lengths lengthwise of the boat, the spaces between the lines of sampling to be 4-6-8 scoop lengths, according to the tonnage as described before.

SAMPLING OF HARD ORE.

In sampling hard lump ore the sampler shall begin sampling, and use the same spacing as defined for soft ore, using hammer lengths instead of scoop lengths. At each point sampled he shall take lump or fine ore equal to one cubic inch. In taking this cubic inch, the sampler shall take an average from the lump from which the cubic inch is broken.

MOISTURE SAMPLE.

The moisture sample shall be taken from the standard sample in the following manner:

When as many cans of ore have been filled as the stage of unloading will permit, the lump ore shall be broken up and the entire amount of ore so far taken shall be mixed and quartered twice, and from the last quarters to be rejected one scoopful for each can in the original sample shall be put into the moisture can, provided the total number of scoopfuls taken will produce a moisture sample weighing about 20 lbs. In case a moisture sample of such weight is not produced, the sampler shall take two or more scoopfuls per can from the rejected quarters, enough to produce about 20 lbs.

The moisture sample shall at once be placed in a standard moisture can with tightly fitted cover. This shall be accurately weighed, dried at 100° C. until the weight is constant. The loss in weight will represent the moisture in the cargo.

At certain unloading points, it is desired of the consignee of the ore, that the entire sample shall be dried and crushed before any quartering is done. At such unloading points the moisture sample shall be taken as follows:

The sampler shall take one round from each hatch when it is one-half unloaded, three scoop lengths vertically and twelve scoop lengths horizontally, taking only ore from fresh surfaces which have not been exposed to sun or rain. It must be thoroughly mixed at once without breaking down, and 20 lbs. placed in a standard moisture can.

Whenever it is not practical to hold the entire sample until the close of the sampling, before mixing and quartering, it may be quartered at convenient stages of the sampling. This must be done each time exactly alike, by breaking down to one-half inch, mixing and quartering twice, thus preserving the proper proportion of the whole sample.

If in the final quartering the last two quarters exceed a can full, the ore shall be quartered again and one quarter rejected.

The sample may be quartered on the vessel, or may be taken to some other place suitable for that purpose. Samples must be shipped to the crushing plant in standard cans.

CAR SAMPLING.

Not less than ten equal sized samples are taken from each car. When cars are loaded with fine ore with piles in opposite ends, at least five samples are taken from each pile; the first one at the apex of the pile, and the other four at points symmetrically arranged around the sides of the pile, two-thirds of the distance

from the apex to the base of the pile or sides of the car. With cars loaded in the center, the system is the same, except that the center of the side of the pile lengthwise of the car, is the first point and the other four being symmetrically arranged around this point.

When the ten points are located in a car, each of them is supposed to represent a definite area, equal to one-tenth of the ore surface of the car. If the car contains all fine ore, then ten equal sized samples are taken, one from each of the points. If the car contains a mixture of fine and lump ore, with varying amounts of each in the areas included in the different divisions, then each area is judged separately and sampled accordingly. The fine and lump ore are taken each in its proper proportions, the former with the scoop, the latter being chipped, or selected small pieces being taken, each about the size of the first joint of the thumb. The combined sample of fine, chipped and selected pieces from each area, equals the amount taken were it all fine ore. If the contents of the car were all lump ore, the proper sized pieces were chipped from four or five of the lumps in each of the ten areas, making forty or fifty pieces from each car, the total amount of the chipped pieces from each of the areas equaling the amount that would be taken were it all fine ore. All samples of fine ore are taken from well underneath the surface to obtain the ore in its natural state.

This method is based primarily on the assumption that a small representative portion of ore taken from a large number of places in different parts of the cargo, will necessarily show the average composition of the cargo. Each year the Lake Superior ores are being more and more mixed, to establish certain grades. This mixture starts in the pockets of the loading docks, is continued as the various pockets are loaded in the boat, and further mixed as the ore is unloaded from the boat into cars or on stockpile, and again mixed as the ore is unloaded at its destination. It is in the case of the more or less mixed ores that the present standard method is particularly applicable. The Independent Chemists fully realize the importance of the sampling, and are ever ready to consider suggestions, whereby the present method may be improved.

METHODS OF ANALYSES

The following rapid methods of analyses are in general use:

Determination of Moisture.

The ore samples are received from the boats in tightly covered tin cans. The sample for analysis weighs about thirty-five pounds, and that for moisture about twenty pounds. The entire

moisture sample is emptied out into a shallow pan 24 x 18 x 2 inches. The pan is first weighed and then the pan and wet ore are weighed together. The pan of ore is placed in an enclosed steam coil and subjected to 212° F. heat for about twelve hours or until the weight is constant. The pan and ore are then weighed, and from the loss in weight, the percentage of moisture is calculated.

The sample for analysis is treated in the same way, and the moisture calculated. This is for an approximate check on the action moisture determination. It generally runs from .2% to .1% lower than the moisture in the moisture sample. This is because the sample has been exposed more or less to the air on the boat.

Crushing.

The sample for analysis after being dried is all put through a Gates Crusher, until it entirely passes through a $\frac{1}{4}$ " sieve. The sample is thoroughly mixed and quartered through a Braun Quartering Machine, to about ten pounds. This ten pounds is ground in steel rolls until it all passes a 20 mesh sieve. After thoroughly mixing, this is quartered through the same machine to about one-half pound. This one-half pound is divided into two equal portions, and one portion put through a 100 mesh sieve. This portion is used for analysis. The other portion is kept in a box in case any check determinations are necessary.

Before analysis, the entire sample is dried for one hour at 100° C., removed from the oven and kept in a dessicator.

IRON. Weigh one-half gram of the ore into a 150 c. c. beaker, add 10 c. c. of a mixture, (concentrated hydrochloric acid 3 parts, and stannous chloride 1 part), cover with a watch glass and heat slowly to boiling on a hot plate, agitating the solution. After boiling for one minute, the beaker is removed to a warm place on the hot plate and left standing until the solution is complete. When the residue in the beaker appears perfectly white, reduce with stannous chloride from a burette, until the solution becomes colorless; add three drops excess. Add 15 c. c. mercuric chloride solution and wash the contents of the beaker into a titration jar containing 100 c. c. to 150 c. c. of water and 25 c. c. of the manganous sulphate mixture. Titrate with potassium permanganate to the first pink color. The permanganate should be of such strength that 1 c. c. equals .005 gram of iron, or every c. c. should correspond to 1% iron, when one-half gram portion of the ore is taken.

SOLUTIONS.

Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

Manganous Sulphate.

480 grams manganous sulphate, 10700 c. c. water, 1 litre phosphoric acid (85%) and 2800 c. c. strong sulphuric acid.

Permanganate Solution Values.

- 1 c. c. equals .005000 grams iron.
- 1 c. c. equals .002500 grams lime.
- 1 c. c. equals .001473 grams manganese.
- 1 c. c. equals .000814 grams phosphorus.

Stannous Chloride.

375 grams dissolved in 1 litre of water and 1 litre of strong hydrochloric acid.

Mercuric Chloride.

700 grams dissolved in 14 litres of water.

PHOSPHORUS. For Bessemer ores weigh five grams, for Non Bessemer ores weigh one gram into a 250 c. c. beaker. Add 50 to 75 c. c. concentrated hydrochloric acid, cover with a watch glass and heat gradually to boiling, holding this temperature until the ore appears to be completely dissolved. Slightly raise the cover glass by means of a glass hook and evaporate the solution gradually until the mass becomes nearly dry; do not bake. Cool and add 15 c. c. of concentrated nitric acid. Heat gently until all the brown fumes are removed. Add 20 to 30 c. c. of hot water and filter into an Erlenmeyer's Flask (500 or 600 c. c. capacity). Wash the residue six times with hot water. Ignite the residue very strongly in a platinum crucible and return it into the beaker in which the original solution was made. Moisten with water and add 5 c. c. of concentrated nitric acid. Evaporate slowly until almost dry (about 1 c. c.). Dilute with hot water and filter into the main filtrate, which has in the meantime been concentrated to a small bulk (about 80 to 100 c. c.). The residue is discarded. The solution is made alkaline with strong ammonia and the precipitate of iron is dissolved with a very slight excess of strong nitric acid. Heat to 70° C. and add 40 c. c. of molybdate solution. Shake for five minutes, filter and wash six times with 2% nitric acid. Place about 10 to 15 grams of mossy zinc in the original flask, place the funnel in the flask and dissolve the yellow precipitate on the paper with two washings of ammonia, (1 to 3) this to be followed with two washings of water. Pour into the flask 150 to 200 c. c. of dilute sulphuric acid and heat gently for 20 minutes. Filter through a cotton plug into a titrating jar and wash the flask twice with water, and finally the cotton plug twice with water. Titrate with potassium permanganate of such a strength that 1 c. c. corresponds to .001628% phosphorus; when a 5 gram portion of the ore is taken.

SOLUTION.

Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

Molybdate.

No. 1 Solution. 3750 c. c. strong nitric acid added to 6000 c. c. water, mix and cool.

No. 2 Solution. 750 grams molybdic acid (Merk's 85%) dissolved in a mixture of 1500 c. c. water and 1500 c. c. strong ammonia. Mix and cool. Add No. 2 Solution slowly, to No. 1 Solution, passing a current of air through the solution to thoroughly mix. Let stand for forty-eight hours before using.

MANGANESE. Three grams of the ore are dissolved by gentle heating, in 75 c. c. of concentrated hydrochloric acid in a 500 c. c. beaker, covered with a watch glass. When the solution is complete add 1 c. c. of nitric acid and 25 c. c. of dilute sulphuric acid, and hasten the evaporation by raising the watch glass slightly. Evaporate to white fumes of sulphuric acid. Cool, and add 150 to 200 c. c. of water, and heat to boiling. Boil five minutes and cool. When cool, transfer the solution to a graduated cylinder, add zinc oxide suspended in water, continuously shaking the solution until there is a slight excess, shown by the yellowish appearance of the precipitate formed. Dilute with water to exactly 600 c. c. in the graduated cylinder, mix the contents thoroughly by shaking, and filter. Of the filtrate take two portions, each 200 c. c., and place in Florence flasks (500 c. c. capacity). Heat to boiling and titrate while boiling, with potassium permanganate. 1 c. c. equals .001473 grams manganese or corresponds to .1473% manganese if one gram portion of the ore is taken.

SOLUTION.

Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

SILICA. Fuse one gram of ore with five grams of sodium carbonate in a capacious platinum crucible. Cool and dissolve the fusion in an evaporating dish with dilute hydrochloric acid. Cover the dish with a five inch watch glass and evaporate to dryness. Cool, moisten with hydrochloric acid, evaporate and bake. Cool, and add 30 c. c. of dilute hydrochloric acid, heat to boiling. When completely dissolved, filter and wash with hot dilute hydrochloric acid and hot water, alternately, until no iron stain shows. Weigh as silica.

ALUMINA. To the filtrate from the silica, add about 1 c. c. nitric acid and heat to boiling. Add strong ammonia in very slight excess, boil a minute and filter while hot. Wash thoroughly with hot water. Dissolve the precipitate on the paper with hot dilute hydrochloric acid, re-precipitate with ammonia, filter and wash. The filtrates are used for lime determination. The precipitate on the paper is dissolved with boiling hot dilute hydrochloric acid into a 600 c. c. beaker. Add strong ammonia with constant stirring until a deep mahogany color is obtained. If a precipitate is formed add a drop or two of dilute hydrochloric acid, until it is just dissolved, then add ammonia to the proper color. Add 3.3 c. c. of concentrated hydrochloric acid, 10 c. c. of a 10% ammonium phosphate solution, and 30 c. c. of a sodium hyposulphite solution (equivalent to 10 grams of the salt) followed by 5 c. c. of glacial acetic acid. Cover and heat gradually to boiling, with occasional stirring, and boil 15 minutes. Filter with moderate suction and wash eight times with boiling water. Ignite in a weighed porcelain crucible and weigh as aluminum phosphate. The weight times .4185 equals the weight of alumina.

SOLUTION.

Ammonium Phosphate.

100 grams dissolved in 1 litre of water.

LIME. The filtrate from the iron and alumina hydrates is evaporated to 150 or 200 c. c. and 10 c. c. of a saturated solution of ammonium oxalate added while boiling. Add 10 c. c. of strong ammonia and boil 10 minutes. Allow to stand in a warm place for two hours until completely settled, then filter through double papers washing eight times with hot water. Ignite in a weighed platinum crucible, finishing in a blast until the weight is constant. Cool in a dessicator and weigh as lime.

SOLUTION.

Ammonium Oxalate.

50 grams dissolved in 1 litre of water.

MAGNESIA. The filtrate from the calcium oxalate in the lime determination is made slightly acid with hydrochloric acid. Add 10 c. c. of ammonium phosphate solution. Cool and add drop by drop with constant stirring, 25 c. c. of concentrated ammonium hydrate and continue stirring a few minutes. Let stand in a cool place six hours, filter and wash with water containing 10% ammonia and 5% ammonium nitrate. Ignite in a porcelain crucible and weigh as magnesium pyro phosphate. Factor for magnesia is .3624.

SOLUTION.**Ammonium Phosphate.**

225 grams dissolved in 1 litre of water.

SULPHUR. Weigh into a 500 c. c. beaker five grams of ore and add 200 to 250 c. c. aqua regia (1 part nitric acid and 9 parts hydrochloric acid). Cover and heat gently until the ore is dissolved. Raise the watch glass on glass hooks and evaporate to dryness. Cool and dissolve in about 15 to 20 c. c. of concentrated hydrochloric acid. Boil, dilute and filter. Wash with a little hot dilute hydrochloric acid and hot water. The solution is diluted to about 400 c. c. with water and heated to boiling. Add 10 c. c. of a 10% barium chloride solution, boil 10 or 15 minutes and evaporate slowly until ferric chloride begins to crystallize out. Dilute to about 400 c. c. with cold water and let stand all night.

The residue of the ore which does not go into solution in the aqua regia is ignited in a platinum crucible and fused with a mixture of sodium carbonate and potassium nitrate, and the fusion dissolved in hot water. Filter, wash with hot water, acidify the filtrate with hydrochloric acid, evaporate to dryness and bake. Dissolve in hot water and add 10 c. c. of dilute hydrochloric acid. Filter and dilute the filtrate to 300 c. c. with water and add 10 c. c. of barium chloride solution. Boil for fifteen minutes, let settle, and filter on the same paper with the main solution which has stood over night. Ignite in a platinum crucible and weigh as barium sulphate. The factor for sulphur is .13732.

SOLUTION.**Barium Chloride.**

100 grams dissolved in 1 litre of water.

Loss On Ignition.

One gram of the ore is placed in a weighed platinum crucible with a tightly fitting cover and heated to a bright red heat over a Bunsen Burner for fifteen minutes. Cool in a dessicator and weigh. Heat five minutes more and weigh, repeat until the weight remains constant. The loss in weight is the "Loss on Ignition."

FIGURING PRICE OF ORE FROM ANALYSIS

For many years the value of ores was arrived at, by adding the freight rate to the furnace, to the price quoted per ton at Lake Erie Ports, and dividing this sum by the percentage of natural iron. This gave a base unit value which, multiplied by the percentage of natural iron, gave the selling price of the ore.

In 1908 a new method of figuring the value of ores was

adopted by most of the ore brokers. This method was thought to be fairer to the furnace interests than that used formerly.

The Lake Superior ores are divided into four classes:

Old Range Bessemer Ores, containing 55% Iron Natural, .045% Phosphorus dry.

Old Range Non-Bessemer Ores, containing 51.50% Iron Natural.

Mesabi Bessemer Ores, containing 55.00% Iron Natural, .045% Phosphorus dry.

Mesabi Non-Bessemer Ores, containing 51.50% Iron Natural.

To arrive at the base unit value of any particular ore, add 60 cts. (the average freight rate on ore shipped from Lake Erie Ports) to the quoted selling price and divide by the guaranteed Natural Iron. Doing this, and taking for example, the following selling prices:

Old Range Bessemer Ores, \$5.00 per ton, called the base price.

Old Range Non-Bessemer Ores, \$4.20 per ton, called the base price.

Mesabi Bessemer Ores, \$4.75 per ton, called the base price.

Mesabi Non-Bessemer Ores, \$4.00 per ton, called the base price.

The base units are as follows:

Old Range Bessemer Ores.....	\$0.10182
Old Range Non-Bessemer Ores.....	0.09320
Mesabi Bessemer Ores.....	0.09727
Mesabi Non-Bessemer Ores.....	0.08932

To figure the value of Bessemer Ores, the following tables are used:

For Ores Analyzing Under 55% Iron Natural:

From 55% to 50% Iron Natural, the value of each unit is the base unit.

From 50% to 49% Iron Natural, the value is the base unit increased 50%.

From 49% to 48% Iron Natural, the value is the base unit increased 100%.

Less than 48% Iron Natural, the value of each unit is 18 cents or whatever figure is named in the ore contract.

For Ores Analyzing Above 55% Iron Natural:

From 55% to 56% Iron Natural, the value is the base unit increased 1 cent.

From 56% to 57% Iron Natural, the value is the base unit increased 2 cents.

From 57% to 58% Iron Natural, the value is the base unit increased 3 cents.

From 58% to 59% Iron Natural, the value is the base unit increased 4 cents.

From 59% to 60% Iron Natural, the value is the base unit increased 5 cents.

Over 60% Iron Natural, the value of each unit is the base unit value, or whatever figure is named in the Contract.

The Phosphorus adjustment is made according to the Phosphorus table, a copy of which is herewith shown.

Percentage of Phosphorous	Rate of Progression	Phos. Values	Percentage of Phosphorous	Rate of Progression	Phos. Values
.070	.0200	.3500	.037	.0115	.0780
.069	.0195	.3300	.036	.0120	.0900
.068	.0190	.3105	.035	.0125	.1025
.067	.0185	.2915	.034	.0130	.1155
.066	.0180	.2730	.033	.0135	.1290
.065	.0175	.2550	.032	.0140	.1430
.064	.0170	.2375	.031	.0145	.1575
.063	.0165	.2205	.030	.0150	.1725
.062	.0160	.2040	.029	.0155	.1880
.061	.0155	.1880	.028	.0160	.2040
.060	.0150	.1725	.027	.0165	.2205
.059	.0145	.1575	.026	.0175	.2550
.058	.0140	.1430	.025	.0175	.2550
.057	.0135	.1290	.024	.0180	.2730
.056	.0130	.1155	.023	.0185	.2915
.055	.0125	.1025	.022	.0190	.3105
.054	.0120	.900	.021	.0195	.3300
.053	.0115	.0780	.020	.0200	.3500
.052	.0110	.0665	.019	.0205	.3705
.051	.0105	.0555	.018	.0210	.3915
.050	.0100	.0450	.017	.0215	.4130
.049	.0095	.0350	.016	.0220	.4350
.048	.0090	.0255	.015	.0225	.4575
.047	.0085	.0165	.014	.0230	.4805
.046	.0080	.0080	.013	.0235	.5040
.045	.0000	.0000	.012	.0240	.5280
.044	.0080	.0080	.011	.0245	.5525
.043	.0085	.0165	.010	.0250	.5775
.042	.0090	.0255	.009	.0255	.6030
.041	.0095	.0350	.008	.0260	.6290
.040	.0100	.0450	.007	.0265	.6555
.039	.0105	.0555	.006	.0270	.6825
.038	.0110	.0665	.005	.0275	.7100

To figure the value of Non-Bessemer ores the following tables are used:

For Ores Analyzing under 53% Iron, Natural:

From 53% to 50% Iron Natural, the value is the base unit.

From 50% to 49% Iron Natural, the value is the base unit increased 50%.

From 49% to 48% Iron Natural, the value is the base unit increased 100%.

Less than 48% Iron Natural, the value of each unit is 18 cents, or whatever figure is named in the ore contract.

For Ores Analyzing Over 53% Iron, Natural:

From 53% to 54% Iron Natural, the value is the base unit increased 1 cent.

From 54% to 55% Iron Natural, the value is the base unit increased 2 cents.

From 55% to 56% Iron Natural, the value is the base unit increased 3 cents.

From 56% to 57% Iron Natural, the value is the base unit increased 4 cents.

From 57% to 58% Iron Natural, the value is the base unit increased 5 cents.

Over 58% Iron Natural, the value of each unit is the base unit value.

These calculations may be illustrated as follows:

Suppose the analysis of an Old Range Bessemer ore is 48.00% Iron Natural and .045% Phosphorus dried at 212° F. and that the base Old Range Bessemer ore which is guaranteed 55% Iron Natural and .045% Phosphorus dried at 212° F. selling for \$5.00 per ton delivered to Lake Erie Ports. The actual selling price would be calculated as follows:

55% to 50% equals 5 units. 5 times the base unit equals	\$50909
50% to 49% equals 1 unit. 1 times the base unit plus 50% equals.....	.15272
49% to 48% equals 1 unit. 1 times the base unit plus 100% equals .....	.20363
Penalty for Iron	\$.86544
Penalty for Phosphorus (from the Table) .....	.045
Total Penalty	\$.91044
or 91 cts. per ton.	

This penalty subtracted from the base price, namely, \$5.00 gives \$4.09 as the value of the ore.

Suppose the analysis of a Mesabi Bessemer ore is 59.50% Iron Natural and .045% Phosphorus dried at 212° F. and that the base Mesabi Bessemer ore which is guaranteed at 55% Iron Natural and .045% Phosphorus dried at 212° F. is selling at \$4.75 per ton. The actual selling price would be calculated as follows:

From 55% to 56% equals 1 unit. 1 times base unit plus 1c equals....	\$10727
From 56% to 57% equals 1 unit. 1 times base unit plus 2c equals....	.11727
From 57% to 58% equals 1 unit. 1 times base unit plus 3c equals....	.12727
From 58% to 59% equals 1 unit. 1 times base unit plus 4c equals....	.13727
From 59% to 59.50% equals ½ unit. ½ times base unit plus 5c equals....	.07364
Premium for Iron.....	\$.56272
Premium for Phosphorus (from table) .....	.0165
Total Premium	\$.57922

This premium of 58 cts. added to the base price, namely, \$4.75 gives \$5.33 as the value of the ore.

Suppose the analysis of an Old Range Non-Bessemer ore is 48% Iron Natural and that the base Old Range Non-Bessemer ore which is guaranteed 51.50% Iron Natural is selling for \$4.20 per ton delivered to Lake Erie Ports. The actual selling price would be calculated as follows:

51.50% to 50% equals 1.5 units. 1.5 times base unit equals.....	\$13298
50.00% to 49% equals 1 unit. 1 times base unit plus 50% equals.....	.13398
49% to 48% equals 1 unit. 1 times base unit plus 100% equals....	.17864
Total Penalty	\$.44560

This penalty subtracted from the base price, namely, \$4.00, gives \$3.55 as the value of the ore.

Suppose the analysis of a Mesabi Non-Bessemer ore is 55% Iron Natural and that the base Mesabi Non-Bessemer ore which is guaranteed at 51.50% Iron Natural is selling for \$4.00 per ton delivered at Lake Erie Ports. The actual selling price would be calculated as follows:

From 51.50% to 53% = 1½ unit.	1½ times base unit.....	= \$1.3398
From 53 % to 54% = 1 unit.	1 times base unit plus 50%.....	= .13398
From 54% to 55% = 1 unit.	1 times base unit plus 100%.....	= .17864
Premium for Iron		\$4.4660

This premium of 45 cts. added to the base price, namely, \$4.00, gives \$4.45 as the value of the ore.

In a manganiferous ore, the manganese is generally calculated as a metal with the iron, that is, the total percentage of iron and manganese in the natural, are used as a percentage of iron in calculating the value of the ore.

Silicious ores, that is, ores showing 20% or more silica, are generally sold for a special price.

VALUE OF IRON ORES

The first iron ore sold at Lower Lake Ports was in 1855 and the price was \$10.00 per ton at the Lower Lake Ports. The next year the price dropped to \$8.00 per ton, for both Bessemer and Non-Bessemer.

From 1856 till 1872, the price of Bessemer and Non-Bessemer ore was practically the same, but this price fluctuated between the low figure of \$5.25 per ton in 1860 to the high figure of \$10.50 per ton in 1867.

From 1872 to date the price of Bessemer ore has been higher than that of Non Bessemer ore. The difference has varied from \$3.00 per ton in 1873 to the present 1910 prices, at which time there is a difference of 80 cts. per ton between the Old Range Bessemer and the Non-Bessemer, and a difference of 75 cts. per ton between the Mesabi Bessemer and the Non-Bessemer ores.

Prices of Iron Ore at Lower Lake Ports for Each Range Since Opening

YEAR	MARQUETTE		MENOMINEE		VERMILLION		MESABI	
	Bessemer	Non-Bessemer	Bessemer	Non-Bessemer	Bessemer	Non-Bessemer	Bessemer	Non-Bessemer
1855.....	\$10.00	\$10.00						
1856.....	8.00	8.00						
1857.....	8.00	8.00						
1858.....	6.50	6.50						
1859.....	6.00	6.00						
1860.....	5.25	5.50						
1861.....	5.25	5.00						
1862.....	5.25	5.37						
1863.....	7.50	7.50						
1864.....	8.50	8.50						
1865.....	7.50	7.50						
1866.....	9.50	9.50 to 14.00						
1867.....	10.50	8.00 to 11.50						
1868.....	8.25	8.25						
1869.....	8.25	9.50						
1870.....	8.50	8.50 to 9.50						
1871.....	8.00	8.00						
1872.....	9.00	7.50						
1873.....	12.00	9.00						
1874.....	9.00	7.00						
1875.....	7.00	5.50						
1876.....	6.75	4.50						
1877.....	6.50	4.25						
1878.....	5.50	4.25						
1879.....	6.25	4.75						
1880.....	9.25	8.00						
1881.....	9.00	7.00						
1882.....	9.00	6.25						
1883.....	6.25	5.00	\$6.00	\$4.75				
1884.....	5.76	4.50	5.25	4.50	\$4.75	\$4.50		
1885.....	5.50	4.25	4.75	4.00	5.00	4.00		
1886.....	5.50	4.75	5.25	4.50	5.75	4.50		
1887.....	7.25	5.25	6.00	5.00	6.75	5.00		
1888.....	5.50	4.75	4.75	4.00	5.75	4.00		
1889.....	5.50	4.50	4.50	4.50	5.50	4.50		
1890.....	6.75	5.75	5.50	5.25	6.50	5.50		
1891.....	6.00	4.75	4.50	4.25	5.50	4.00		
1892.....	5.50	4.85	4.50	3.65	5.65	4.85		
1893.....	4.25	3.00 to 3.50	3.85	3.20	4.50	4.00	\$3.00	
1894.....	2.75	2.15	2.75	2.50	3.35	3.00	2.35	
1895.....	2.75 to 3.50	2.15 to 2.30	2.90	2.25	3.40	3.00	2.15	\$1.90
1896.....	4.00	2.45 to 2.85	4.00	2.70	3.50	2.25	3.50	2.25
1897.....	2.65	2.00 to 2.60	2.60	2.15	2.25	1.90	2.25	1.90
1898.....	3.10 to 3.35	2.35 to 2.45	2.75	1.85	2.25	1.75	2.25	1.75
1899.....	3.21 to 3.50	2.50	3.00	2.15	2.40	2.00	2.40	2.00
1900.....	5.93 to 6.48	5.00	5.50	4.25	4.50	4.00	4.50	4.00
1901.....	4.66 to 4.92	3.65 to 3.85	4.25	3.00	3.25	2.75	3.25	2.75
1902.....	4.65 to 5.00	3.80 to 4.00	4.25	3.25	3.25	2.75	3.25	2.75
1903.....	4.85 to 5.15	4.00 to 4.25	4.50	3.60	4.00	3.20	4.00	3.20
1904.....	3.60 to 3.85	3.10 to 3.35	3.25	2.75	3.00	2.50	3.00	2.50
1905.....	3.75	3.20	3.75	3.20	3.50	3.00	3.50	3.00
1906.....	4.25	3.70	4.25	3.70	4.00	3.50	4.00	3.50
1907.....	5.00	4.20	5.00	4.20	4.75	4.00	4.75	4.00
1908.....	4.50	3.70	5.00	4.20	4.75	4.00	4.75	4.00
1909.....	4.50	3.70	4.50	3.70	4.50	3.70	4.25	3.50
1910.....	5.00	4.20	5.00	4.20	5.00	4.20	4.75	4.00

LOCATION
and
DESCRIPTION
of
MINES

MARQUETTE RANGE

AMERICAN MINE.

Location: Marquette County, Michigan, Section 32, Township 48, Range 28.

Description: Re-opened in 1906. Two ores are shipped from this mine, AMERICAN, a hard, silver gray, 1st grade Bessemer Specular; and ALLIANCE, a hard, silver gray, 2nd grade Bessemer Specular. Ore is crushed.

The mine is worked by underground stoping system. Greatest vertical depth 850 feet.

The ore is shipped via the D., S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there to the lower lake ports by boat.

The mine is operated by the American-Boston Mining Co. Some ore shipped prior to 1893 from Sterling mine.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1880—	797 tons	1890—	21,000 tons
1881—	4,702 tons	1891—	21,604 tons
1882—	8,006 tons	1892—	15,076 tons
1883—	3,618 tons	1893	to 1905—
1884—	2,916 tons	1906—	419 tons
1885—		1907—	13,764 tons
1886—		1908—	23,222 tons
1887—	1,483 tons	1909—	90,001 tons
1888—	13,699 tons	1910—	163,290 tons
1889—	20,032 tons		

Total, Tons403,629

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

American:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.60	.040	12.34	.04	3.44	.31	.36	.011	1.10

Alliance:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.18	.039	17.54	.03	4.14	.25	.48	.022	1.07

The Ore in its natural state is as follows:

American:

Moist	Iron	Phos.	Silica
2.05	56.42	.039	12.09

Alliance:

Moist	Iron	Phos.	Silica
1.71	52.27	.038	17.24

ANGELINE MINE.

Location: Marquette County, Michigan, Section 15, Township 47 North, Range 27 West. It is in the city of Ishpeming.

Description: First opened up in 1864. Two ores are shipped from this mine. ANGELINE HEMATITE, a soft, red, Bessemer Hematite; SOUTH ANGELINE HEMATITE, a soft, red, Non-Bessemer Hematite.

It is an underground mine worked by slicing system. Greatest vertical depth 515 feet.

The mine is operated by Pittsburgh & Lake Angeline Iron Co.

The ore is shipped via. the L. S. & I., D. S. & A., C. & N. W. Railways to L. S. & I. docks, Marquette, and from there to the lower lake ports.

Yearly Shipments:

1864—	19,500 tons	1888—	223,600 tons
1865—	20,151 tons	1889—	229,070 tons
1866—	24,073 tons	1890—	261,681 tons
1867—	46,607 tons	1891—	241,605 tons
1868—	26,651 tons	1892—	287,517 tons
1869—	39,694 tons	1893—	351,973 tons
1870—	53,467 tons	1894—	355,453 tons
1871—	33,645 tons	1895—	313,555 tons
1872—	35,221 tons	1896—	342,251 tons
1873—	43,933 tons	1897—	489,685 tons
1874—	30,499 tons	1898—	460,333 tons
1875—	30,282 tons	1899—	464,988 tons
1876—	22,539 tons	1900—	389,128 tons
1877—	19,113 tons	1901—	481,574 tons
1878—	28,161 tons	1902—	304,125 tons
1879—	25,420 tons	1903—	310,950 tons
1880—	14,794 tons	1904—	262,486 tons
1881—	18,060 tons	1905—	374,183 tons
1882—	14,326 tons	1906—	269,116 tons
1883—	27,259 tons	1907—	283,373 tons
1884—	86,922 tons	1908—	220,410 tons
1885—	93,287 tons	1909—	280,298 tons
1886—	123,382 tons	1910—	244,923 tons
1887—	191,120 tons		

Total, Tons8,530,383.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Angeline Hematite:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
65.30	.041	3.79						

South Angeline Hematite:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.95	.128	4.40						

The Ore in its natural state is as follows:

Angeline Hematite:

Moist	Iron	Phos.	Silica
9.32	59.21	.037	3.43

South Angeline Hematite:

Moist	Iron	Phos.	Silica
10.08	57.50	.115	3.95

AUSTIN MINE.

Location: Marquette County, Michigan, Section 20, Township 45, Range 25.

Description: First opened up in 1903. Ore is a soft, Non-Bessemer Hematite.

Mine is worked by the caving system. Greatest vertical depth 318 feet.

The ore is shipped via the Munising and C. & N. W. Railways to Presque Isle and Escanaba.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1907—195,950 tons	1909—125,858 tons
1908—111,229 tons	1910—188,588 tons
Total, Tons .....621,625	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.80	.086	8.95	.52	.71	.88	.28	.012	.95

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.00	52.29	.074	7.70

BESSIE MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 29.

Description: First opened up in 1890. Ore is a soft, brown, Non-Bessemer Hematite and Limonite.

Mine is shut down at present. Greatest vertical depth 200 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there by boat to the lower lake ports.

Sales Agents: John M. Longyear, Marquette, Mich.

Yearly Shipments:

1891— 847 tons	1904—
1892-1901—	1905— 21,879 tons
1902— 5,007 tons	1906— 1,646 tons
1903— 29,718 tons	Total, Tons .....59,097

BREITUNG HEMATITE NO. 1.

Location: Marquette County, Michigan, N. W. $\frac{1}{4}$, S. W. $\frac{1}{4}$ of Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1901. Four ores are shipped from this mine, FOLEY and FOLEY NO. 2, soft, red and blue, low phosphorous Bessemer Hematites; BREITUNG SILICIOUS, and HEMATITE SILICIOUS, semi-hard, red and blue Bessemer Silicious Hematites.

The mine is worked by the caving system. Greatest vertical depth 367 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

The mine was shut down from 1903 to 1909. Reopened in 1909.

Sales Agents: E. N. Breitung & Co., Cleveland.

Yearly Shipments for Breitung Hematite Nos. 1 and 2.

1903—	7,854 tons	1907—	59,667 tons
1904—	9,869 tons	1908—	55,849 tons
1905—		1909—	129,673 tons
1906—	38,671 tons	1910—	114,202 tons
Total, Tons .....415,785			

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Foley:	Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
	63.27	.017	6.43	.08	1.45	.18	.18	.010	1.50

Foley No. 2:	Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
	54.88	.018	17.85	.08	1.70	.22	.11	.010	1.50

Breitung Silicious:	Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
	43.20	.018	33.94	.21	1.93	1.21	trace	.027	.79

Hematite Silicious:	Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
	43.00	.033	34.00	.84	2.24	1.68	.12	.008	1.58

The Ore in its natural state is as follows:

Foley:	Moist	Iron	Phos.	Silica
	7.74	58.37	.016	5.93

Foley No. 2:	Moist	Iron	Phos.	Silica
	8.06	50.45	.017	16.41

Breitung Silicious:	Moist	Iron	Phos.	Silica
	6.46	40.41	.017	31.75

Hematite Silicious:	Moist	Iron	Phos.	Silica
	6.00	40.42	.031	31.96

BREITUNG HEMATITE NO. 2.

Location: Marquette County, Michigan, S. E. $\frac{1}{4}$, N. W. $\frac{1}{4}$ of Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1902. Two ores shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

The mine is worked by the caving system. Greatest vertical depth 369 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co., Cleveland.

For Shipments see Breitung No. 1.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mary:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.73	.103	8.35	.23	2.98	.62	.63	.026	2.59

Charlotte:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.35	.090	14.60	.45	2.85	.81	1.40	.022	1.96

The Ore in its natural state is as follows:

Mary:			
Moist	Iron	Phos.	Silica
13.47	50.82	.089	7.23

Charlotte:			
Moist	Iron	Phos.	Silica
11.56	48.07	.080	12.91

CAMBRIA MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 27.

Description: First opened up in 1875. The ore is a hard, brown, Non-Bessemer Hematite.

It is operated as a stoping and subing mine. Greatest vertical depth 883 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there by boat to the lower lake ports.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna Co., Cleveland.

Yearly Shipments:

1875—	2,610 tons	1877—	10,085 tons
1876—	6,329 tons	1878—	3,754 tons

1879—	6,724 tons	1895—	41,656 tons
1880—	6,958 tons	1896—	95,086 tons
1881—	19,246 tons	1897—	110,648 tons
1882—	64,545 tons	1898—	102,623 tons
1883—	47,508 tons	1899—	124,930 tons
1884—	59,742 tons	1900—	80,432 tons
1885—	50,796 tons	1901—	68,907 tons
1886—	58,784 tons	1902—	63,976 tons
1887—	41,136 tons	1903—	41,168 tons
1888—	57,865 tons	1904—	84,852 tons
1889—	72,780 tons	1905—	81,791 tons
1890—	80,359 tons	1906—	40,628 tons
1891—	34,662 tons	1907—	135,145 tons
1892—	41,549 tons	1908—	85,977 tons
1893—	30,445 tons	1909—	136,815 tons
1894—	47,218 tons	1910—	150,422 tons

Total, Tons2,188,149

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.90	.093	9.82	.24	2.64	.76	.48	.013	3.17

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.98	51.54	.083	8.74

CHAMPION MINE.

Location: Marquette County, Michigan, Sections 31 and 32, Township 48. Range 29.

Description: First opened up in 1867. Ore is No. 1 Lump, a hard, blue, Non-Bessemer Hematite.

It is an underground mine. Greatest vertical depth, 2,292 feet.

The ore is shipped via the C. & N. W. and C. M. & St. P. Railways to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1867—	500 tons	1880—	112,401 tons
1868—	6,225 tons	1881—	145,427 tons
1869—	19,458 tons	1882—	159,009 tons
1870—	73,161 tons	1883—	104,960 tons
1871—	41,625 tons	1884—	210,180 tons
1872—	68,405 tons	1885—	173,915 tons
1873—	72,782 tons	1886—	137,593 tons
1874—	46,769 tons	1887—	146,330 tons
1875—	57,979 tons	1888—	174,680 tons
1876—	66,002 tons	1889—	215,098 tons
1877—	70,883 tons	1890—	223,442 tons
1878—	73,464 tons	1891—	133,413 tons
1879—	94,027 tons	1892—	109,979 tons

1893— 61,648 tons	1902—205,721 tons
1894— 42,788 tons	1903— 74,238 tons
1895—100,398 tons	1904— 174 tons
1896—113,375 tons	1905— 64,680 tons
1897—141,728 tons	1906—145,007 tons
1898—163,190 tons	1907—107,577 tons
1899—215,074 tons	1908— 313 tons
1900—113,743 tons	1909— 11,199 tons
1901— 69,026 tons	1910— 18,746 tons

Total, Tons4,413,331

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.90	.078	5.15						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
.88	61.35	.077	5.11

CLIFF SHAFT MINE.

Location: Marquette County, Michigan, Sections 9 and 10, Township 47, Range 27.

Description: First opened up in 1887. Two ores are shipped from this mine, CRUSHED CLIFF SHAFT and LUMP CLIFF SHAFT, both hard, red, Non-Bessemer, Specular. The ore is crushed and screened.

It is worked as an open, over hand, stoping mine. The pillars are left. Greatest vertical depth 736 feet.

The ore is shipped via the L. S. & I., C. & N. W., and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Cliff Shaft.

1887— 87,346 tons	1892—289,395 tons
1888— 78,520 tons	1893—130,812 tons
1889—134,616 tons	1894—253,760 tons
1890—188,776 tons	1895—259,042 tons
1891—278,270 tons	

Cleveland Cliffs Group.

Prior to 1888—3,704,954 tons	1900— 881,021 tons
1888— 184,316 tons	1901— 860,484 tons
1889— 274,048 tons	1902—1,104,864 tons
1890— 331,713 tons	1903— 810,845 tons
1891— 221,788 tons	1904— 743,263 tons
1892— 310,907 tons	1905—1,288,416 tons
1893— 348,917 tons	1906—1,330,944 tons
1894— 797,466 tons	1907—1,030,928 tons
1895— 480,195 tons	1908— 438,379 tons
1896— 513,119 tons	1909— 877,433 tons
1897— 718,408 tons	1910— 955,374 tons
1898— 869,482 tons	Total, Tons .....22,405,270
1899—1,011,048 tons	

		Cleveland Cliffs Iron Co.
Prior to		1894— 143,706 tons
1887—	3,497,513 tons	1895— 221,153 tons
1887—	207,441 tons	1896— 513,119 tons
1888—	184,316 tons	1897— 718,408 tons
1889—	274,048 tons	1898— 869,482 tons
1890—	331,713 tons	1899— 1,011,048 tons
1891—	221,788 tons	1900— 881,021 tons
1892—	310,907 tons	1901— 860,484 tons
1893—	218,105 tons	1902— 1,104,864 tons
Total, Tons		.....11,569,116

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Crushed Cliff Shaft:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.20	.112	6.42	.51	2.74	1.87	.82	.014	1.92

Lump Cliff Shaft:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.70	.103	4.90	.79	2.46	1.75	1.12	.016	2.75

The Ore in its natural state is as follows:

Crushed Cliff Shaft:

Moist	Iron	Phos.	Silica
1.00	58.61	.111	6.36

Lump Cliff Shaft:

Moist	Iron	Phos.	Silica
.50	59.40	.102	4.88

EMPIRE MINE.

Location: Marquette County, Michigan, Section 19, Township 47, Range 26.

Description: First opened up in 1907. Ore is a hard, red, silicious Hematite. Ore is crushed to two inch size. It is an open pit milling mine. Greatest vertical depth 200 feet.

The ore is shipped via the C. & N. W. Railway to Escanaba, Mich., and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1907— 40,565 tons	1909—108,993 tons
1908— 53,537 tons	1910— 53,687 tons
Total, Tons .....256,782	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
40.23	.074	40.60	.08	1.02	.49	.24	.025	1.10

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
3.03	39.01	.072	39.37

HARTFORD MINE.

Location: Marquette County, Michigan, Section 36, Township 48, Range 27.

Description: First opened up in 1889. There are two ores shipped from this mine, BERNHART and AVERHART, hard, brown, Non-Bessemer Hematites.

The mine is worked by the stoping system. Greatest vertical depth 1,075 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there by boat to the lower lake ports.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1889—	566 tons	1901—	
1890—		1902—	7,440 tons
1891—		1903—	20,085 tons
1892—	5,678 tons	1904—	179,980 tons
1893—	6,513 tons	1905—	322,209 tons
1894—	940 tons	1906—	364,801 tons
1896—	1,532 tons	1907—	328,161 tons
1897—		1908—	278,366 tons
1898—		1909—	250,680 tons
1899—		1910—	183,471 tons
1900—			

Total, Tons1,950,422

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bernhart:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.14	.074	11.98						

Averhart:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.52	.059	8.04						

The Ore in its natural state is as follows:

Bernhart:

Moist	Iron	Phos.	Silica
10.00	50.53	.066	10.78

Averhart:

Moist	Iron	Phos.	Silica
10.07	53.52	.053	7.23

HIMROD MINE.

Location: Marquette County, Michigan, Section 7, Township 47 North, Range 26 West.

Description: First opened up in 1873. The ore is hard, red, silicious Hematite. It is worked as an open pit mine.

The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there to the lower lake ports by boat.

Sales Agents: E. N. Breitung & Co., Cleveland.

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.75	.054	36.20	.03	1.28	.38	.05	.005	1.50

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
4.00	40.08	.052	34.75

IMPERIAL MINE.

Location: Baraga County, Michigan, Section 25, Township 48, Range 31.

Description: First opened up in 1882. The ore is a soft, yellow, Non-Bessemer Limonite.

The mine is worked by the open stoping and caving system. Greatest vertical depth 186 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1890—	38,460 tons	1901—	
1891—	18,552 tons	1902—	
1892—	7,194 tons	1903—	
1893—		1904—	727 tons
1894—		1905—	1,661 tons
1895—		1906—	5,076 tons
1896—		1907—	55,756 tons
1897—		1908—	48,231 tons
1898—		1909—	115,478 tons
1899—	23,235 tons	1910—	83,404 tons
1900—	62,321 tons		

Total, tons460,095

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.40	.302	11.15	.180	.64	2.98	2.12	.021	8.63

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.70	45.39	.267	9.85

JACKSON MINE.

Location: Marquette County, Michigan, Section 1, Township 47, Range 27.

Description: First opened up in 1846. Two ores are shipped from this mine, JACKSON BESSEMER and SOUTH JACKSON, both hard, red, silicious and mangiferous Specular. The ore is crushed. It is worked as an open pit mine.

The ore is shipped via the L. S. & I., C. & N. W., and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Prior to 1857—28,463 tons	1884—83,251 tons
1857—12,442 tons	1885—68,657 tons
1858—10,309 tons	1886—89,370 tons
1859—28,377 tons	1887—109,606 tons
1860—41,295 tons	1888—101,909 tons
1861—12,919 tons	1889—128,891 tons
1862—46,096 tons	1890—124,682 tons
1863—77,237 tons	1891—92,979 tons
1864—83,905 tons	1892—92,567 tons
1865—65,505 tons	1893—51,009 tons
1866—92,287 tons	1894—32,298 tons
1867—127,491 tons	1895—42,186 tons
1868—130,524 tons	1896—80,710 tons
1869—125,908 tons	1897—79,102 tons
1870—127,642 tons	1898—55,012 tons
1871—138,297 tons	1899—88,230 tons
1872—119,910 tons	1900—31,714 tons
1873—130,131 tons	1901—38,271 tons
1874—94,708 tons	1902—15,449 tons
1875—87,283 tons	1903—5,409 tons
1876—98,480 tons	1904—
1877—80,340 tons	1905—33,180 tons
1878—83,121 tons	1906—5,066 tons
1879—12,921 tons	1907—61,345 tons
1880—120,622 tons	1908—
1881—118,939 tons	1909—11,060 tons
1882—96,830 tons	1910—40,320 tons
1883—71,278 tons	

Total, Tons3,925,533

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Jackson Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
50.30	.042	24.50	.10	2.00	.35	.08	.015	1.00

South Jackson:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.70	.086	31.50	2.60	1.51	.34	.27	.022	2.48

The Ore in its natural state is as follows:

Jackson Bessemer:

Moist	Iron	Phos.	Silica
2.00	49.29	.041	24.01

South Jackson:

Moist	Iron	Phos.	Silica
7.25	38.68	.080	29.22

LAKE MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1888. There are two ores shipped from this mine, LAKE, a soft, Non-Bessemer Hematite; and LAKE BESSEMER, a soft Bessemer Hematite. It is worked by the caving system. Greatest vertical depth 555 feet.

The ore is shipped via the L. S. & I., C. & N. W. and D. S. S. & A. Railways to Presque Isle and Escanaba and from there to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1892—188,439 tons	1901—406,783 tons
1893—162,700 tons	1902—448,427 tons
1894—94,715 tons	1903—456,514 tons
1895—160,790 tons	1904—399,621 tons
1896—162,326 tons	1905—568,568 tons
1897—339,521 tons	1906—600,002 tons
1898—386,088 tons	1907—552,530 tons
1899—464,549 tons	1908—250,252 tons
1900—457,453 tons	1909—463,478 tons
	1910—244,923 tons

Total, Tons6,807,679

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Lake:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.70	.108	6.68	.70	2.68	.65	.98	.015	3.75

Lake Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.00	.048	9.73	.54	1.27	.66	.30	.011	1.45

The Ore in its natural state is as follows:

Lake:

Moist	Iron	Phos.	Silica
13.00	51.07	.094	5.81

Lake Bessemer:

Moist	Iron	Phos.	Silica
13.30	51.02	.042	8.44

LAKE SUPERIOR (Hard) MINE.

Location: Marquette County, Michigan, Sections 9 and 10, Township 47, Range 27.

Description: First opened up in 1857. Eight grades of ore are shipped from this mine, ABBOTSFORD, a hard, blue, Bessemer Hematite; BERESFORD LUMP, hard, steel blue, Non-Bessemer Hematite; BERESFORD CRUSHED, a hard, steel blue, Non-Bessemer Hematite; CASTLEGUARD, a hard, blue, Bessemer, Silicious Hematite; CASTLEFORD, a hard, dark gray, Non-Bessemer, Silicious Hematite; HEMATITE, a hard, dark red, Non-Bessemer Hematite; HIGH GRADE HEMATITE, a hard, dark red, Non-Bessemer Hematite; and CHATFORD, a hard, Non-Bessemer, Silicious Hematite. The Beresford ore is crushed. It is an underground mine. Greatest vertical depth 1,070 feet. The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

This mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

Lake Superior	1884—204,796 tons
1857—	1885—226,040 tons
1858— 4,658 tons	1886—267,622 tons
1859— 24,668 tons	1887—302,909 tons
1860— 33,015 tons	1888—240,225 tons
1861— 25,195 tons	1889—288,784 tons
1862— 37,709 tons	1890—318,321 tons
1863— 78,976 tons	1891—308,831 tons
1864— 86,773 tons	1892—366,715 tons
1865— 55,201 tons	1893—329,610 tons
1866— 68,002 tons	1894—344,758 tons
1867—119,935 tons	1895—342,439 tons
1868—105,745 tons	1896—459,576 tons
1869—135,560 tons	1897—376,761 tons
1870—166,582 tons	1898—686,563 tons
1871—158,047 tons	1899—682,595 tons
1872—195,617 tons	1900—709,143 tons
1873—158,428 tons	1901—635,642 tons
1874—124,311 tons	1902—832,796 tons
1875—129,365 tons	1903—604,829 tons
1876—110,570 tons	1904—590,339 tons
1877—127,349 tons	1905—727,378 tons
1878—109,674 tons	1906—635,671 tons
1879—174,747 tons	1907—674,066 tons
1880—204,094 tons	1908—261,955 tons
1881—262,235 tons	1909—349,435 tons
1882—296,509 tons	1910—271,445 tons
1883—200,799 tons	

Total, Tons15,233,008

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Abbotsford:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.13	.033	6.30						

Beresford Lump:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.58	.110	5.40						

Castleguard:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.01	.045	20.87						

Castleford:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.97	.086	16.51						

High Grade Hematite:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.40	.082	8.39						

The Ore in its natural state is as follows:

Abbotsford:

Moist	Iron	Phos.	Silica
3.78	59.78	.032	7.98

Beresford Lump:

Moist	Iron	Phos.	Silica
1.59	61.59	.108	5.32

Castleguard:

Moist	Iron	Phos.	Silica
4.48	50.63	.043	19.94

Castleford:

Moist	Iron	Phos.	Silica
3.81	51.91	.082	15.88

High Grade Hematite:

Moist	Iron	Phos.	Silica
13.78	52.08	.070	7.23

LAKE SUPERIOR (Soft) MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1857. Four grades of ore are shipped from this mine, ALFORD, a soft, reddish blue, Bessemer Hematite; BEDFORD, a soft, dark red, Non-Bessemer Hematite; BEDFORD HIGH SILICIOUS, a soft, dark red, Non-Bessemer Silicious Hematite; and ABBOTSFORD, a soft, blue, Bessemer Hematite.

It is an underground mine. Greatest vertical depth 1,102 feet. The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there to the lower lake ports by boat.

The mine is operated by the Oliver Iron Mining Co.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alford:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.89	.028	6.69						

Bedford:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.11	.073	13.63						

The Ore in its natural state is as follows:

Alford:

Moist	Iron	Phos.	Silica
9.87	56.68	.025	6.03

Bedford:

Moist	Iron	Phos.	Silica
9.98	49.61	.066	12.27

LILLIE MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 27.

Description: First opened up in 1875. The ore is a hard, brown, Non-Bessemer Hematite.

The mine is worked by stoping system. Greatest vertical depth 1,000 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there to the lower lake ports by boat.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1875—	144 tons	1893—	68,861 tons
1876—	5,801 tons	1894—	78,388 tons
1877—	10,127 tons	1895—	54,285 tons
1878—	8,506 tons	1896—	107,532 tons
1879—	22,380 tons	1897—	112,781 tons
1880—	18,347 tons	1898—	211,023 tons
1881—	16,748 tons	1899—	196,200 tons
1882—	27,494 tons	1900—	114,990 tons
1883—	4,614 tons	1901—	98,788 tons
1884—	2,683 tons	1902—	79,919 tons
1885—	708 tons	1903—	77,454 tons
1886—	3,957 tons	1904—	63,209 tons
1887—	23,041 tons	1905—	9,868 tons
1888—	32,692 tons	1906—	32,781 tons
1889—	33,916 tons	1907—	80,545 tons
1890—	31,812 tons	1908—	8,632 tons
1891—	19,551 tons	1909—	61,708 tons
1892—	29,005 tons	1910—	10,121 tons

Total, Tons1,758,611

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.21	.090	9.20	.26	2.56	.78	.40	.016	3.47

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.99	51.23	.079	8.10

LUCY MINE.

Location: Marquette County, Michigan, Section 6 and 7, Township 47, Range 26.

Description: First opened up in 1878. The ore is a silicious and manganiferous soft Hematite.

It is worked by the open stoping and caving system. Greatest vertical depth is 281 feet.

The ore is shipped via the L. S. & I., C. & N. W., D. S. S. & A. Railways to Presque Isle and Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1878— 30,180 tons	1895—
1879— 28,962 tons	1896—
1880— 31,206 tons	1897— 10,033 tons
1881— 28,051 tons	1898— 11,846 tons
1882— 40,406 tons	1899—
1883— 14,676 tons	1900—
1884—	1901—
1885—	1902—
1886—	1903—
1887— 12,139 tons	1904—
1888— 22,276 tons	1905—
1889— 32,982 tons	1906— 85 tons
1890— 43,483 tons	1907—
1891— 27,683 tons	1908— 1,115 tons
1892— 26,326 tons	1909— 1,672 tons
1893— 21,964 tons	1910— 11,257 tons
1894—	

Total, Tons 530,288

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
45.90	.063	23.80	3.30	2.72	.22	.14	.025	2.00

The Ore in its natural state is as follows:

Moist Iron	Phos.	Silica
10.50	41.08	.056 21.30

MAAS MINE.

Location: Marquette County, Michigan, Section 31, Township 48, Range 26.

Description: First opened up in 1902. Ore is a soft, Non-Bessemer Hematite.

The mine is worked by the caving system. Greatest vertical depth 1,100 feet.

The ore is shipped via the L. S. & I. Railway to Presque Isle and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1907— 32,378 tons	1909—159,197 tons
1908— 29,036 tons	1910—208,103 tons
Total, Tons .....428,714	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.80	.089	8.50	.25	2.56	1.23	.27	.018	2.60

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.50	52.04	.079	7.52

MAITLAND SHAFT MINE.

Location: Marquette County, Michigan, Section W. $\frac{1}{2}$ of N. W. $\frac{1}{4}$, Section 30, Township 47 West, Range 26.

Description: First opened up in 1910. Ore is soft, blue, Bessemer, Non-Bessemer and Silicious Hematite.

The mine is in an early stage of development. Greatest vertical depth at present, 300 feet.

No ore has been shipped.

MARY CHARLOTTE NO. 1 MINE.

Location: Marquette County, Michigan, N. E. $\frac{1}{4}$, S. W. $\frac{1}{4}$, Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1903. Two ores are shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

It is worked by the caving system. Greatest vertical depth 365 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba, and from there to the lower lake ports by boat.

Sales Agents: E. N. Breitung & Co., Cleveland.

Yearly Shipments:

1903— 34,303 tons	1907—155,633 tons
1904— 48,885 tons	1908— 99,104 tons
1905—221,738 tons	1909—240,433 tons
1906—257,088 tons	1910—197,522 tons
Total, Tons .....1,254,706	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mary:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.73	.103	8.35	.23	2.98	.62	.63	.026	2.59

Charlotte:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.35	.090	14.60	.45	2.85	.81	1.40	.022	1.96

The Ore in its natural state is as follows:

Mary:

Moist	Iron	Phos.	Silica
13.47	50.82	.089	7.23

Charlotte:

Moist	Iron	Phos.	Silica
11.56	48.07	.079	12.91

MARY CHARLOTTE NO. 2.

Location: Marquette County, Michigan, N. W. $\frac{1}{4}$, S. W. $\frac{1}{4}$ of Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1908. Two ores are shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

The mine is worked by the caving system. Greatest vertical depth 470 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba, and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co., Cleveland.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mary:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.73	.103	8.35	.23	2.98	.62	.63	.026	2.59

Charlotte:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.35	.090	14.60	.45	2.85	.81	1.40	.022	1.96

The Ore in its natural state is as follows:

Mary:

Moist	Iron	Phos.	Silica
13.47	50.82	.089	7.23

Charlotte:

Moist	Iron	Phos.	Silica
11.56	48.07	.079	12.91

MILWAUKEE-DAVIS MINE.

Location: Marquette County, Michigan, Section 7, Township 47 North, Range 26 West.

Description: First opened up in 1879. Two ores are shipped from this mine, MILWAUKEE and DAVIS, both soft, red, Non-Bessemer Hematites.

Greatest vertical depth is 373 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette, and from there by boat to the lower lake ports.

The mine was shut down in 1890, but is now being opened up and developed.

Sales Agents: E. N. Breitung & Co., Cleveland

Yearly Shipments:

MILWAUKEE		Total, Tons	.....375,431
1879—	941 tons	DAVIS (formerly	
1880—	13,142 tons	Grand Rapids,	
1881—	31,635 tons	1887—	1,200 tons
1882—	40,891 tons	1888—	11,611 tons
1883—	805 tons	1889—	20,058 tons
1884—	25,991 tons	1890—	26,426 tons
1885—	38,465 tons	1891—	9,362 tons
1886—	46,693 tons	1892—	22,823 tons
1887—	50,470 tons	1893—	352 tons
1888—	48,908 tons	1894—	12,073 tons
1889—	52,727 tons	1895—	6,764 tons
1890—	24,763 tons	1896—	67 tons
		Total Tons	.....110,736

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Milwaukee:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.05	.105	4.32	.45	.60	1.10	.90	.08	2.10

Davis:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.40	.127	5.25	.45	1.19	1.10	.72	.02	2.08

The Ore in its natural state is as follows:

Milwaukee:

Moist	Iron	Phos.	Silica
10.00	55.85	.095	3.89

Davis:

Moist	Iron	Phos.	Silica
10.00	55.26	.114	4.73

MORO MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1881. SCOTCH ore shipped from this mine. It is a hard, Non-Bessemer, Specular.

The mine is worked by the open, over hand stoping system. Greatest vertical depth 812 feet.

The ore is shipped via the L. S. & I. Railway to Presque Isle and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1892— 42,916 tons	1902— 68,811 tons
1893— 25,824 tons	1903— 72,441 tons
1894— 23,012 tons	1904— 1,993 tons
1895— 12,737 tons	1905— 121,295 tons
1896— 28,003 tons	1906— 106,154 tons
1897— 12,678 tons	1907— 77,292 tons
1898—	1908— 661 tons
1899— 5,459 tons	1909— 47,074 tons
1900— 72,124 tons	1910— 125,430 tons
1901—	

Total, Tons843,904

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.30	.140	8.40	.12	2.72	.58	.12	.020	.30

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
.50	60.00	.139	8.36

NEGAUNEE MINE.

Location: Marquette County, Michigan, Sections 5 and 6, Township 47, Range 26.

Description: First opened up in 1887. Two ores are shipped from this mine, NEGAUNEE, a soft, Non-Bessemer Hematite; and NEGAUNEE BESSEMER, a soft, Bessemer Hematite.

The mine is worked by the caving system. Greatest vertical depth 686 feet.

The ore is shipped via the L. S. & I., C. & N. W. and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1887— 5,259 tons	1899—195,573 tons
1888— 45,304 tons	1900—126,829 tons
1889— 78,318 tons	1901—234,713 tons
1890— 76,488 tons	1902—204,286 tons
1891— 64,218 tons	1903—224,665 tons
1892— 85,846 tons	1904—145,132 tons
1893— 69,732 tons	1905—239,554 tons
1894—132,581 tons	1906—253,488 tons
1895— 90,682 tons	1907—296,170 tons
1896—175,394 tons	1908—232,219 tons
1897—182,169 tons	1909—312,217 tons
1898—191,330 tons	1910—348,818 tons

Total, Tons4,010,945

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Negaunee:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.80	.089	8.50	.25	2.56	1.23	.27	.018	2.60

Negaunee Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.80	.060	7.65	.24	2.69	1.12	.23	.013	2.20

The Ore in its natural state is as follows:

Negaunee:

Moist	Iron	Phos.	Silica
11.50	52.04	.079	7.52

Negaunee Bessemer:

Moist	Iron	Phos.	Silica
11.00	53.22	.053	6.81

OHIO MINE (Formerly Beaufort Mine).

Location: Baraga County, Michigan, Section 22, Township 48 North, Range 31 West.

Description: First opened up in 1881. Ore is a soft, brown, Non-Bessemer Hematite.

It is an underground mine.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there to the lower lake ports by boat.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1882—	5,532 tons	1902—	59,781 tons
1883—	18,976 tons	1903—	134,648 tons
1884—	18,360 tons	1904—	25,781 tons
1885—	17,166 tons	1905—	38,306 tons
1886—	17,354 tons	1906—	
1887—	12,829 tons	1907—	78,029 tons
1888-1899—		1908—	61,035 tons
1900—	1,583 tons	1909—	72,987 tons
1901—	4,338 tons	1910—	23,427 tons

Total, Tons590,132

OGDEN MINE.

Location: Marquette County, Michigan, Section 13, Township 47, Range 27.

Description: Opened up about forty years ago. The ore is called TILDEN SILICA, a hard, silicious Hematite.

It is a quarry on a side hill, all above the Railway.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Prior to 1898—	986	1900—	15,325 tons
1898—	50,833 tons	1901—	10,642 tons
1899—	27,345 tons	1902—	4,621 tons
Total Tons		109,752	

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.70	.045	37.10	.37	.69	.30	.13	.010	1.20

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
1.34	41.14	.044	36.60

PORTLAND MINE.

Location: Baraga County, Michigan, Section 26, Township 48 North, Range 31 West.

Description: First opened up in 1909. The ore is a soft, yellow, Non-Bessemer Hematite and Limonite.

It is an open pit mine, operated with the steam shovel. Greatest vertical depth 40 feet. This mine is controlled by Rogers Brown Iron Co.

The ore is shipped via the D., S. S. & A. Railway to docks at Marquette, and via the C. & N. W. Railway to docks at Escanaba, and from there to the lower lake ports by boat.

Yearly Shipments:

1910— 49,584 tons

PRINCETON MINE.

Location: Marquette County, Michigan, Sections 18 and 20, Township 45, Range 25.

Description: First opened in 1872. There are two ores shipped from this mine, PRINCETON and CAMBRIDGE, soft, Non-Bessemer Hematites.

Mine is worked by the caving system. Greatest vertical depth 383 feet.

The ore is shipped via the C. & N. W. and Munising Railways to Escanaba and Presque Isle and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Swanzy and Cheshire Combined.

1872—	13,415 tons
1873—	9,329 tons
1874—	
1875—	188 tons
1876—	225 tons
1877—	8,423 tons
1878—	16,924 tons
1879—	17,985 tons
1880—	13,202 tons
1881—	5,674 tons

SWANZEY

1881—	9,337 tons
1882—	31,498 tons
1883—	13,730 tons
1884—	3,557 tons
1885—	
1886—	8,328 tons
1887—	2,842 tons
1888—	
1889—	
1890—	

PRINCETON

1891—	7,301 tons
1892—	29,403 tons
1893—	19,096 tons
1894—	
1895—	6,593 tons
1896—	
1897—	
1898—	25,247 tons
1899—	55,802 tons
1900—	75,037 tons
1901—	67,051 tons
1902—	118,048 tons
1903—	84,223 tons
1904—	76,461 tons
1905—	129,079 tons
1906—	166,894 tons
1907—	177,863 tons
1908—	36,033 tons
1909—	42,934 tons
1910—	89,441 tons

Total, Tons1,361,202

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Princeton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.70	.197	8.80	.48	.95	1.60	.62	.013	1.20

Cambridge:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.00	.667	6.12	.74	1.07	2.15	.42	.014	1.25

The Ore in its natural state is as follows:

Princeton:

Moist	Iron	Phos.	Silica
14.00	51.34	.169	7.56

Cambridge:

Moist	Iron	Phos.	Silica
14.00	51.60	.574	5.26

QUEEN MINE.

Location: Marquette County, Michigan, Section 5, Township 47, Range 26.

Description: First opened up in 1888. Two ores are shipped from this mine, BUFFALO and CAMEO, hard, and soft, dark red, Non-Bessemer Hematites.

It is an underground mine. Greatest vertical depth 923 feet. The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1888— 5,527 tons	1900—398,298 tons
1889— 66,122 tons	1901—400,845 tons
1890—141,632 tons	1902—418,044 tons
1891—479,509 tons	1903—254,658 tons
1892—379,719 tons	1904—311,479 tons
1893—106,864 tons	1905—253,377 tons
1894—220,298 tons	1906—221,096 tons
1895—160,817 tons	1907—309,917 tons
1896—323,057 tons	1908—104,098 tons
1897—239,774 tons	1909—237,509 tons
1898— 61,022 tons	1910—230,119 tons
1899—342,978 tons	

Total, Tons6,222,540

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Buffalo:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.02	.112	6.18						

Cameo:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.24	.104	8.77						

The Ore in its natural state is as follows:

Buffalo:

Moist	Iron	Phos.	Silica
14.36	51.40	.096	5.30

Cameo:

Moist	Iron	Phos.	Silica
14.41	48.99	.089	7.51

REPUBLIC MINE.

Location: Marquette County, Michigan, Section 7, Township 46, Range 29.

Description: First opened up in 1872. Ore is principally Specular, a small part being Magnetite. Four ores are shipped from this mine, REPUBLIC, a hard, blue and black Bessemer; and KINGSTON, BASIC and LUMP, hard, blue and black, Non-Bessemer. Ore is crushed.

It is worked by the underhand stoping system, using broken ore to stand on. Greatest vertical depth 1,950 feet.

The ore is shipped via the D., S. S. & A., C. M. & St. P. and C. N. & W. Railway to Marquette and Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1872—11,025 tons	1892—167,991 tons
1873—105,453 tons	1893—64,195 tons
1874—122,639 tons	1894—105,719 tons
1875—119,726 tons	1895—174,027 tons
1876—120,095 tons	1896—127,360 tons
1877—165,836 tons	1897—124,342 tons
1878—176,221 tons	1898—140,312 tons
1879—135,231 tons	1899—137,085 tons
1880—235,387 tons	1900—130,126 tons
1881—233,786 tons	1901—104,604 tons
1882—235,109 tons	1902—157,646 tons
1883—152,565 tons	1903—155,415 tons
1884—277,757 tons	1904—124,506 tons
1885—250,835 tons	1905—150,699 tons
1886—241,161 tons	1906—177,220 tons
1887—220,624 tons	1907—170,554 tons
1888—235,062 tons	1908—67,999 tons
1889—287,390 tons	1909—176,575 tons
1890—220,065 tons	1910—150,732 tons
1891—191,127 tons	

Total, Tons6,344,203

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Republic:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.80	.049	7.93	.04	1.44	.56	.61	.028	.28

Basic:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.65	.077	5.54	.06	1.50	.56	.90	.027	.14

Lump:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
66.40	.094	2.36	.06	.95	.52	.72	.012	None

The Ore in its natural state is as follows:

Republic:

Moist	Iron	Phos.	Silica
.96	62.20	.049	7.85

Basic:

Moist	Iron	Phos.	Silica
1.33	62.80	.076	5.47

Lump:

Moist	Iron	Phos.	Silica
.82	65.86	.093	2.34

RICHMOND MINE.

Location: Marquette County, Michigan, Section 28, Township 47, Range 26.

Description: First opened up in 1896. Ore is hard, red, silicious Hematite, and is crushed.

It is an open pit mine.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Richmond Iron Co.

Sales Agents: M. A. Hanna Co., Cleveland.

Yearly Shipments:

1896— 1,088 tons	1904— 68,134 tons
1897— 4,630 tons	1905— 86,129 tons
1898— 24,464 tons	1906— 89,563 tons
1899— 4,613 tons	1907— 35,156 tons
1900— 51,303 tons	1908— 60,994 tons
1901— 54,181 tons	1909— 102,566 tons
1902— 50,041 tons	1910— 95,772 tons
1903— 55,593 tons	

Total, Tons784,227

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
40.90	.040	38.10	.12	.81	.35	.80	.014	1.31

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
3.03	39.66	.039	36.95

ROLLING MILL MINE.

Location: Marquette County, Michigan, City of Negaunee.

Description: First opened up in 1872. Ore is a soft, red, Non-Bessemer Hematite.

Mine is worked by the underground slicing system. Greatest vertical depth 698 feet.

The ore is shipped via the L. S. & I., D. S. S. & A., and C. & N. W. Railway to L. S. & I. docks, Marquette, and from there by boat to the lower lake ports.

The mine is operated by Jones & Laughlin Ore Co.

Yearly Shipments:

1872— 6,772 tons	1888— 402 tons
1873— 11,319 tons	1897— 3,975 tons
1874— 16,643 tons	1898—
1875— 37,806 tons	1899—
1876— 53,265 tons	1900— 22,585 tons
1877— 38,121 tons	1901— 22,815 tons
1878— 30,773 tons	1902— 24,874 tons
1879— 10,039 tons	1903— 6,786 tons
1880— 15,172 tons	1904—
1881— 1,668 tons	1905— 28,766 tons
1882— 163 tons	1906—
1883— 1,528 tons	1907— 49,204 tons
1884— 1,820 tons	1908— 52,147 tons
1885— 3,437 tons	1909— 133,139 tons
1886— 4,403 tons	1910— 115,193 tons
1887— 1,058 tons	

Total, Tons694,109

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.76	.102	8.25						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.65	51.60	.088	7.12

SALISBURY MINE.

Location: Marquette County, Michigan, Section 15, Township 47, Range 27.

Description: First opened up in 1872. Three ores are shipped from this mine, CLINTON, a soft, Non-Bessemer Hematite; CLINTON SILICA, a soft, silicious Hematite; and SALISBURY, a soft, Non-Bessemer Hematite.

The mine is worked by caving system. Greatest vertical depth is 900 feet.

The ore is shipped via the L. S. & I., C. & N. W., D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

SALISBURY		
1872—	440 tons	1882— 42,243 tons
1873—	11,023 tons	1883— 17,028 tons
1874—	7,480 tons	1884— 26,629 tons
1875—	4,330 tons	1885— 29,503 tons
1876—	20,315 tons	1886— 51,667 tons
1877—	37,660 tons	1887— 48,304 tons
1878—	52,155 tons	1888— 74,947 tons
1879—	39,293 tons	1889— 72,449 tons
1880—	21,457 tons	1890— 85,798 tons
1881—	43,690 tons	1910— 85,098 tons

Total, Tons771,509

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Clinton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.50	.220	6.75	.30	2.30	.70	.23	.014	2.57

Clinton Silica:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.50	.106	19.35	.26	2.46	.30	.16	.012	2.68

Salisbury:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.10	.110	7.00	.60	3.00	1.20	1.20	.040	2.50

The Ore in its natural state is as follows:

Clinton:

Moist	Iron	Phos.	Silica
12.00	53.24	.194	5.94

Clinton Silica:

Moist	Iron	Phos.	Silica
12.50	45.06	.093	16.93

Salisbury:

Moist	Iron	Phos.	Silica
14.00	50.83	.095	6.02

STAR WEST MINE (formerly Wheat Mine).

Location: Marquette County, Michigan, Section 29, Township 47, Range 26.

Description: First opened up in 1879. Ore is a soft, blue, silicious, Bessemer Hematite. Ore is crushed.

It is an underground mine.

Sales Agents; Corrigan, McKinney Co., Cleveland.

Yearly Shipments:

1879—	851 tons	1891—	4,412 tons
1880—	3,323 tons	1892—	
1881—	9,040 tons	1893—	
1882—	9,554 tons	1894—	5,550 tons
1883—	6,625 tons	1895—	51,207 tons
1884—	6,824 tons	1896—	9,658 tons
1885—	9,200 tons	1897—	942 tons
1886—	15,867 tons	1898—	
1887—	17,538 tons	1899—	6,716 tons
1888—	4,987 tons	1900—	15,987 tons
1889—	7,997 tons		
1890—	15,141 tons		

Total, Tons204,649

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.16	.037	18.42	.21	.76	1.10	.85	.002	1.12

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
1.76	53.21	.036	18.09

STEGMILLER MINE.

Location: Marquette County, Michigan, Section 17, Township 45, Range 25.

Description: First opened up in 1909. Ore is a hard and soft, silver blue, Non-Bessemer Hematite.

It is an underground mine. Greatest vertical depth 346 feet.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1909— 39,869 tons	1910— 48,842 tons
Total, Tons .....88,711	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.34	.381	6.97						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.74	51.44	.325	5.95

STEPHENSON MINE.

Location: Marquette County, Michigan, Section 20, Township 45, Range 25.

Description: First opened up in 1904. Ore is a soft, Non-Bessemer Hematite.

Mine is worked by the caving system. Greatest vertical depth 413 feet.

The ore is shipped via the Munising and C. & N. W. Railways to Presque Isle and Escanaba and from there to the lower lake ports by boat.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1907— 6,305 tons	1909— 64,075 tons
1908— 52,588 tons	1910—225,726 tons
Total, Tons .....348,694	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.00	.667	6.12	.74	1.07	2.15	.42	.014	1.25

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.00	51.60	.574	5.26

VOLUNTEER MINE.

Location: Marquette County, Michigan, South ½ of Southwest ¼, Section 30, Township 47, Range 26 West.

Description: First opened up in 1871.

The mine is idle and has been for the past three years.

The ore is shipped via the C. & N. W., and D. S. S. & A. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

Yearly Shipments:

1871— 4,171 tons	1890—141,524 tons
1872— 39,495 tons	1891— 92,699 tons
1873— 41,204 tons	1892—127,130 tons
1874— 16,106 tons	1893— 69,561 tons
1875— 4,070 tons	1894— 26,946 tons
1876— 15,324 tons	1895— 32,672 tons
1877— 20,211 tons	1896— 53,216 tons
1878— 5,929 tons	1897— 1,617 tons
1879— 24,663 tons	1898—
1880— 38,881 tons	1899— 29,983 tons
1881— 39,276 tons	1900— 47,578 tons
1882— 41,456 tons	1901—
1883— 19,414 tons	1902— 32,736 tons
1884— 11,748 tons	1903— 7,395 tons
1885— 5,679 tons	1904— 71,870 tons
1886— 24,034 tons	1905—106,281 tons
1887— 47,486 tons	1906— 38,544 tons
1888— 56,321 tons	1907— 10,022 tons
1889— 60,156 tons	

Total, Tons1,405,398

WASHINGTON MINE.

Location: Marquette County, Michigan, Section 11, Township 47 North, Range 29 West.

Description: First opened up in early sixties. Three grades of ore are shipped from this mine, WASHINGTON, WASHINGTON NO. 2, and WASHINGTON SILICIOUS, all hard, steel gray, Non-Bessemer Specular Hematite. Crushed to one inch size.

The mine is worked by back stoping and underhand system. Greatest vertical depth 572 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette and from there by boat to the lower lake ports.

Mine was idle several years and reopened in 1908 by Washington Iron Co. Old name, Barron Mine.

Sales Agents: E. N. Breitung & Co., Cleveland.

Yearly Shipments:

HUMBOLT	
1865— 4,782 tons	1872— 38,841 tons
1866— 15,150 tons	1873— 38,014 tons
1867— 25,440 tons	1874— 27,890 tons
1868— 35,757 tons	1875— 9,642 tons
1869— 58,462 tons	1876— 3,333 tons
1870— 79,762 tons	1877— 16,545 tons
1871— 48,725 tons	1878— 33,920 tons
	1879— 18,204 tons

1880— 14,726 tons	1891— 19,879 tons
1881— 26,302 tons	1892— 4,571 tons
1882— 43,463 tons	1893—
1883— 31,866 tons	1894—
1884— 23,763 tons	1895—
1885— 11,766 tons	1896— 2,297 tons
1886— 20,207 tons	Total, Tons .....723,961
1887— 19,873 tons	WASHINGTON
1888— 11,655 tons	1908— 20,625 tons
1889— 15,866 tons	1909— 44,716 tons
1890— 23,259 tons	1910— 96,769 tons
Total, Tons .....162,110	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Washington:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.20	.137	10.43	.06	1.52	.93	.84	.021	.34

Washington No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.12	.123	14.03	.33	1.68	.66	.62	.016	1.60

Washington Silicious:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
50.00	.100	25.00	.44	.84	.88	.10	.031	.42

The Ore in its natural state is as follows:

Washington:

Moist	Iron	Phos.	Silica
.98	59.61	.136	10.33

Washington No. 2:

Moist	Iron	Phos.	Silica
.77	56.68	.122	13.92

Washington Silicious:

Moist	Iron	Phos.	Silica
1.00	49.50	.099	24.75

MICHIPICOTON RANGE

HELEN MINE.

Location: Michipicoton, Ont.

Description; First opened up in 1900. Two ores are shipped from this mine, HELEN No. 1 and HELEN No. 2, both brown, hard, Non-Bessemer Hematites. The underground long wall system of mining is used. The greatest vertical depth is 480 feet. The ore is shipped via Algoma Central Railway to Michipicoton Harbor Dock, and from there by boat.

The ore is crushed to pass a 2½ inch ring.

Sales Agents: R. A. Seelye, Sault Ste. Marie, Ont.

Yearly Shipments:

Prior to 1904—803,160 tons	1907—142,832 tons
1904—118,354 tons	1908—148,420 tons
1905—169,526 tons	1909—170,065 tons
1906—121,550 tons	1910—115,790 tons
Total, Tons.....1,789,705	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Helen No. 1:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.77	.127	4.40	.17	.88	.23	.44	.136	10.40

Helen No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.19	.127	4.40	.17	.88	.23	.14	.447	10.40

The Ore in its natural state is as follows:

Helen No. 1:

Moist	Iron	Phos.	Silica
5.70	54.41	.120	4.15

Helen No. 2:

Moist	Iron	Phos.	Silica
5.70	53.93	.120	4.15

GOGEBIC RANGE

ANVIL MINE.

Location: Gogebic County, Michigan, Section 14, Township 47 North, Range 46 West.

Description: First opened up in 1887. Three ores are shipped from this mine, ANVIL and ROWE, both soft, red, Bessemer Hematites; and ROWE No. 2, a soft, red, Non-Bessemer Hematite. Sub-slicing system of mining is used. The greatest vertical depth is 1,700 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1887— 10,075 tons	1900—
1888— 24,676 tons	1899—
1889— 47,000 tons	1901— 1,101 tons
1890— 45,690 tons	1902— 135,502 tons
1891— 73 tons	1903— 11,309 tons
1892— 42,090 tons	1904— 45,595 tons
1893—	1905— 82,118 tons
1894— 13,297 tons	1906— 79,493 tons
1895— 68,064 tons	1907— 39,495 tons
1896— 57,483 tons	1908— 35,937 tons
1897—	1909— 22,927 tons
1898— 5,037 tons	1910— 7,235 tons
Total, Tons .....774,197	

ASTEROID MINE.

Location; Gogebic County, Michigan, Section 13, Township 47, Range 46.

Description: First opened up in 1906. The ore is soft, red, Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 884 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

ASHLAND MINE.

Location: Gogebic County, Michigan, Section 22, Township 47, Range 47.

Description: First opened up in 1884. This mine ships two ores, ASHLAND, a soft, red, Bessemer Hematite; and GLOBE, a soft, red, Non-Bessemer Hematite. Sub-level with top slicing and caving systems of mining are used. The greatest vertical depth is 1,324 feet.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: The Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1885— 6,741 tons	1898—123,208 tons
1886— 74,015 tons	1899—154,615 tons
1887—175,563 tons	1900—232,961 tons
1888—174,183 tons	1901—286,399 tons
1889—257,915 tons	1902—301,824 tons
1890—435,946 tons	1903—274,138 tons
1891—267,439 tons	1904—344,102 tons
1892—231,896 tons	1905—409,131 tons
1893— 66,067 tons	1906—241,841 tons
1894— 83,020 tons	1907—298,056 tons
1895—126,096 tons	1908—259,611 tons
1896— 91,149 tons	1909—259,612 tons
1897—111,625 tons	1910—231,506 tons

Total, Tons5,618,390

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Ashland:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.00	.048	10.35	.28	3.03	.27	.22	.010	2.78

Globe:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.85	.103	11.00	.28	2.87	.53	.47	.017	2.20

The Ore in its natural state is as follows:

Ashland:

Moist	Iron	Phos.	Silica
10.60	51.85	.043	9.25

Globe:

Moist	Iron	Phos.	Silica
10.00	52.06	.093	9.90

ATLANTIC MINE.

Location: Iron County, Michigan, Sections 1 and 12, Township 45, Range 1.

Description: First opened up in 1887. The ore is a hard and soft, reddish brown, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,208 feet.

The ore is shipped via the Minneapolis, St. Paul & Sault Ste. Marie and Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1887— 1,369 tons	1899— 19,964 tons
1888—	1900—135,955 tons
1889—	1901—190,135 tons
1890—	1902—190,213 tons
1891—	1903—148,385 tons
1892—	1904— 77,424 tons
1893—	1905—208,039 tons
1894—	1906— 97,689 tons
1895— 70,989 tons	1907— 91,759 tons
1896— 60,727 tons	1908— 41,465 tons
1897— 50,307 tons	1909—124,845 tons
1898— 38,058 tons	1910— 79,847 tons

Total, Tons1,626,970

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.85	.035	10.15	.33					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.25	53.11	.031	9.01

BROTHERTON MINE.

Location: Gogebic County, Michigan, Section 9, Township 47, Range 45 West.

Description: First opened up in 1886. The mine ships BROTHERTON and BROTHERTON No. 2, both Bessemer Hematite; and WALTON, a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,075 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1886— 8,880 tons	1899— 78,858 tons
1887— 21,721 tons	1900— 89,804 tons
1888— 40,639 tons	1901—103,109 tons
1889— 53,267 tons	1902— 53,255 tons
1890— 80,486 tons	1903— 94,986 tons
1891— 46,574 tons	1904— 84,870 tons
1892—130,833 tons	1905—137,351 tons
1893— 18,905 tons	1906—147,281 tons
1894— 47,148 tons	1907—104,224 tons
1895— 40,567 tons	1908— 96,776 tons
1896— 50,496 tons	1909—103,090 tons
1897— 46,186 tons	1910—102,626 tons
1898— 73,198 tons	

Total, Tons1,855,124

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Brotherton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.20	.027	8.59	.42	.82	.24	.26	.006	.64

Brotherton No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.00	.045	10.30	.42	.82	.24	.26	.006	.64

Walton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.00	.085	10.30	.42	.82	.24	.26	.006	.64

The Ore in its natural state is as follows:

Brotherton:

Moist	Iron	Phos.	Silica
8.50	56.91	.025	7.86

Brotherton No. 2:

Moist	Iron	Phos.	Silica
8.50	55.82	.041	9.42

Walton:

Moist	Iron	Phos.	Silica
8.50	55.82	.078	9.43

CARY MINE.

Location: Iron County, Wisconsin, Sections 26 and 27, Township 46, Range 2 East.

Description: First opened up in 1886. This mine ships five ores: CARY EMPIRE, CARY BESSEMER, and WINDSOR, all Bessemer Hematite; and KAKAGON and NIMIKON, both Non-Bessemer Hematite. The underground system of mining is used.

The greatest vertical depth is 1,198 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Odanah

1886—	13,714 tons
1887—	30,475 tons
1888—	5,412 tons
1889—	13,354 tons
1890—	1,065 tons
1891—	121,318 tons
1892—	6,711 tons
1893—	3,956 tons
1894—	2,437 tons

Kakagon

1886—	18,487 tons
1887—	52,179 tons
1888—	1,228 tons

Cary.

1889—	56,542 tons
1890—	116,203 tons
1891—	121,186 tons
1892—	106,484 tons
1893—	31,052 tons
1894—	47,156 tons
1895—	63,787 tons
1896—	66,975 tons
1897—	37,693 tons
1898—	43,162 tons
1899—	62,524 tons
1900—	125,984 tons
1901—	180,215 tons
1902—	136,895 tons
1903—	89,221 tons

1904— 61,860 tons	1909—224,251 tons
1905—146,414 tons	1910—205,674 tons
1906—216,992 tons	Nimikon
1907—209,407 tons	1886— 4,105 tons
1908— 96,358 tons	1887— 23,217 tons
	1888— 1,313 tons

Total, Tons2,745,821

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Cary Empire:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.20	.056	12.22	4.14	.93	.19	.16	.010	4.62

Cary Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulp.	Loss
57.05	.046	12.80	.82	.96	.17	.19	.010	3.18

Windsor:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.05	.046	12.80	.82	.96	.17	.19	.010	3.18

Kakagon:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.80	.076	9.67	3.00	1.01	.37	.34	.007	4.54

Nimikon:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.00	.066	11.72	.36	1.15	.42	.33	.013	2.88

The Ore in its natural state is as follows:

Cary Empire:

Moist	Iron	Phos.	Silica
9.00	48.41	.051	11.12

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Cary Bessemer:

Moist	Iron	Phos.	Silica
9.34	51.72	.042	11.60

Windsor:

Moist	Iron	Phos.	Silica
9.30	51.74	.042	11.61

Kakagon:

Moist	Iron	Phos.	Silica
7.50	51.62	.070	8.94

Nimikon:

Moist	Iron	Phos.	Silica
9.60	52.43	.060	10.60

CASTILE MINE.

Location: Gogebic County, Michigan, Section 10, Township 47, Range 45.

Description: First opened up in 1906. The mine ships two ores, CASTILE, a soft, red, Bessemer Hematite; and MEDINA, a soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,111 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1906—	2,108 tons	1909—	26,982 tons
1907—	6,157 tons	1910—	20,197 tons
1908—			

Total, Tons55,444

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Castile:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.02	.045	13.98	.56	.44	.47	.45	.015	1.00

Medina:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.35	.125	13.01	.60	.60	.54	.39	.013	1.25

The Ore in its natural state is as follows:

Castile:

Moist	Iron	Phos.	Silica
12.52	50.76	.039	12.23

Medina:

Moist	Iron	Phos.	Silica
12.65	50.10	.109	11.36

COLBY MINE.

Location: Gogebic County, Michigan, Section 16, Township 47, Range 46.

Description: First opened up in 1884. This mine ships two ores, COLBY, soft, blue, Bessemer Hematite; and COLBY No. 2, a soft, blue, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1884—	1,022 tons	1898—	152,875 tons
1885—	84,302 tons	1899—	103,239 tons
1886—	257,432 tons	1900—	32,572 tons
1887—	258,518 tons	1901—	23,475 tons
1888—	285,880 tons	1902—	22,526 tons
1889—	136,833 tons	1903—	54,915 tons
1890—	193,038 tons	1904—	81,141 tons
1891—	9,619 tons	1905—	83,736 tons
1892—	69,968 tons	1906—	113,001 tons
1893—	59,346 tons	1907—	94,480 tons
1894—	32,616 tons	1908—	58,305 tons
1895—		1909—	170,095 tons
1896—	48,492 tons	1910—	194,754 tons
1897—	22,921 tons		

Total, Tons2,645,101

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Colby:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.05	.049	7.19	.32	1.53	.93	.82	.005	2.96

Colby No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.65	.060	7.53	.38	1.40	1.05	.91	.007	3.09

The Ore in its natural state is as follows:

Colby:

Moist	Iron	Phos.	Silica
10.40	53.80	.044	6.44

Colby No. 2:

Moist	Iron	Phos.	Silica
10.78	53.22	.054	6.72

EUREKA MINE.

Location: Gogebic County, Michigan, Section 13, Township 47, Range 46.

Description: First opened up in 1890. This mine ships three ores: BELMONT, a soft, red, Bessemer Hematite; and EUREKA and RAMSAY, both soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. Greatest vertical depth 1,173 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1890—	23,794 tons	1901—	
1891—	13,907 tons	1902—	
1892—	10,655 tons	1903—	
1893—	31,385 tons	1904—	
1894—	18,329 tons	1905—	
1895—	26,105 tons	1906—	37,525 tons
1896—	4,544 tons	1907—	57,904 tons
1897—		1908—	122,324 tons
1898—		1909—	115,662 tons
1899		1910—	41,611 tons
1900—			

Total, Tons503,745

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Belmont:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.50	.055	6.65	.70	1.28	.40	.62	.022	2.10

Eureka:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.59	.065	5.76	.83	1.37	.13	.34	.012	1.96

Ramsay:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.48	.094	6.72	.63	1.70	.67	.39	.017	1.90

The Ore in its natural state is as follows:

Belmont:

Moist	Iron	Phos.	Silica
15.31	52.08	.047	5.63

Eureka:

Moist	Iron	Phos.	Silica
15.63	52.81	.055	4.86

Ramsay:

Moist	Iron	Phos.	Silica
15.25	52.10	.080	5.70

GERMANIA MINE (HARMONY IRON CO.)

Location: Iron County, Wisconsin, S. $\frac{1}{2}$, S. W. $\frac{1}{4}$, Section 24 and undivided $\frac{1}{4}$ N. W. $\frac{1}{4}$, Section 25, Township 46, Range 2 East.

Description: First opened in 1883. The mine ships King ore, a soft, red, Non-Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 1,675 feet.

The ore is shipped via the Chicago & Northwestern and the Minneapolis, St. Paul and Sault Ste. Marie Railways to Ashland, and from there by boat to the lower lake ports.

Yearly Shipments:

1885—	5,468 tons	1898—	
1886—	19,734 tons	1899—	1,255 tons
1887—	61,714 tons	1900—	986 tons
1888—	53,918 tons	1901—	10,358 tons
1889—	103,169 tons	1902—	20,502 tons
1890—	52,000 tons	1903—	2,246 tons
1891—	22,383 tons	1904—	23,364 tons
1892—	4,283 tons	1905—	2,973 tons
1893—	7,964 tons	1906—	9,436 tons
1894—		1907—	19,319 tons
1895—		1908—	
1896—		1909—	152 tons
1897—	1,015 tons	1910—	20,080 tons
Total, Tons		442,319	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.50	.064	14.85	.27	1.19	.68	.55	.011	2.55

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.65	49.59	.057	13.27

IRONTON MINE.

Location: Gogebic County, Michigan, Section 17, Township 47, Range 46.

Description: First opened up in 1886. The mine ships two ores, IRONTON, a soft, red, Bessemer Hematite; and IRONTON No. 2, soft, red, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1886—	18,424 tons	1899—	7,977 tons
1887—	24,762 tons	1900—	25,047 tons
1888—		1901—	
1889—	8,635 tons	1902—	8,555 tons
1890—	6,247 tons	1903—	16,875 tons
1891—	300 tons	1904—	23,197 tons
1892—		1905—	41,314 tons
1893—		1906—	106,158 tons
1894—		1907—	190,986 tons
1895—		1908—	92,932 tons
1896—		1909—	277,594 tons
1897—		1910—	109,925 tons
1898—			

Total, Tons958,910

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Ironton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.02	.048	6.98	.36	1.66	.81	.54	.006	3.12

Ironton No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.68	.061	7.85	.35	1.82	.98	.76	.008	2.81

The Ore in its natural state is as follows:

Ironton:

Moist	Iron	Phos.	Silica
10.55	53.69	.043	6.24

Ironton No. 2:

Moist	Iron	Phos.	Silica
10.86	53.20	.054	6.99

MONTREAL MINE.

Location: Iron County, Wisconsin, Section 33, Township 46, Range 2.

Description: First opened up in 1886. The mine ships two ores, MONTREAL and LAWRENCE, both soft, red granular, Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,900 feet. The ore is shipped via the Milwaukee, St. Paul & Sault Ste. Marie Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1886—23,013 tons	1899—153,307 tons
1887—43,989 tons	1900—107,524 tons
1888—38,015 tons	1901—72,945 tons
1889—42,724 tons	1902—136,354 tons
1890—16,728 tons	1903—93,139 tons
1891—70,108 tons	1904—163,021 tons
1892—58,728 tons	1905—107,854 tons
1893—34,299 tons	1906—139,202 tons
1894—46,037 tons	1907—159,763 tons
1895—138,882 tons	1908—177,006 tons
1896—131,531 tons	1909—191,611 tons
1897—191,106 tons	1910—187,325 tons
1898—270,776 tons	

Total, Tons2,991,810

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Montreal:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.64	.045	4.20	.38	.92	trace	trace	.004	3.82

Lawrence:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.24	.055	6.52	.48	1.67	.35	.16	.010	4.00

The Ore in its natural state is as follows:

Montreal:

Moist	Iron	Phos.	Silica
9.80	57.40	.041	3.79

Lawrence:

Moist	Iron	Phos.	Silica
10.70	54.69	.049	5.82

MIKADO MINE.

Location: Gogebic County, Michigan, Section 18, Township 47, Range 45 West.

Description: First opened up in 1895. The ore is a red, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 938 feet.

The ore is shipped via the Chicago & North Western Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1895—4,788 tons	1903—108,709 tons
1896—	1904—25,611 tons
1897—11,397 tons	1905—140,740 tons
1898—	1906—154,043 tons
1899—10,324 tons	1907—163,891 tons
1900—1,090 tons	1908—86,617 tons
1901—91,846 tons	1909—99,195 tons
1902—98,834 tons	1910—52,715 tons

Total, Tons1,049,800

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.10	.109	11.03	.90	.87	.73	.37	.008	2.46

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.50	49.68	.093	9.43

NEWPORT MINE.

Location: Gogebic County, Michigan, Section 24, Township 47 North, Range 47 West.

Description: First opened up in 1886. The mine ships five ores, MELROSE and NEW ERA No. 1, soft, red, Bessemer Hematite; MONTROSE and NEW ERA No. 2, soft, red, Non-Bessemer Hematite; BONNIE, soft, red, manganiferous, Bessemer Hematite. Sub-slicing system of mining is used. The greatest vertical depth is 2,200 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1886—	20,184 tons	1899—	263,711 tons
1887—	75,660 tons	1900—	217,201 tons
1888—	69,145 tons	1901—	190,448 tons
1889—	36,987 tons	1902—	141,571 tons
1890—	71,488 tons	1903—	279,905 tons
1891—	105,606 tons	1904—	171,931 tons
1892—	165,965 tons	1905—	438,023 tons
1893—	109,718 tons	1906—	549,745 tons
1894—	150,392 tons	1907—	551,496 tons
1895—	157,821 tons	1908—	579,390 tons
1896—	142,369 tons	1909—	1,008,354 tons
1897—	150,979 tons	1910—	1,182,324 tons
1898—	196,953 tons		

Total, Tons7,027,363

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Melrose:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.60	.045	5.98	.34	2.70	.67	.17	.014	2.12

New Era No. 1:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.55	.047	12.61	.32	2.97	.63	.14	.020	1.93

Montrose:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.95	.078	6.60	.41	1.63	.35	.56	.033	3.13

New Era No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.95	.080	12.63	.34	3.18	.60	.26	.015	2.67

Bonnie:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
48.35	.047	14.58	6.95	1.02	.20	.95	.023	4.00

The Ore in its natural state is as follows:

Melrose:

Moist	Iron	Phos.	Silica
11.61	54.45	.040	5.29

New Era No. 1:

Moist	Iron	Phos.	Silica
11.99	49.77	.041	11.10

Montrose:

Moist	Iron	Phos.	Silica
10.92	54.29	.069	5.88

New Era No. 2:

Moist	Iron	Phos.	Silica
10.52	50.06	.072	11.30

Bonnie:

Moist	Iron	Phos.	Silica
7.66	44.65	.043	13.46

NORRIE-AURORA MINE.

Location: Gogebic County, Michigan, Sections 22 and 23, Township 47, Range 47.

Description: First opened up in 1884. The mine ships five ores: AURORA, NORRIE, NORDALE and VAUGHN, all reddish brown, hard and soft, Bessemer Hematite; and NORDEN, reddish brown, hard and soft, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,670 feet. Norrie Group includes Pabst Norrie, and Aurora ores.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co. .

Yearly Shipments:

Pabst	1900—239,242 tons
1885— 1,103 tons	1901—198,686 tons
1886— 17,979 tons	Norrie
1887— 19,906 tons	1885— 15,419 tons
1888— 49,979 tons	1886— 124,844 tons
1889— 96,373 tons	1887— 237,254 tons
1890—172,060 tons	1888— 412,196 tons
1891—130,226 tons	1889— 674,394 tons
1892—113,245 tons	1890— 906,728 tons
1893—104,510 tons	1891— 758,572 tons
1894—206,074 tons	1892— 985,216 tons
1895—219,960 tons	1893— 472,062 tons
1896— 68,984 tons	1894— 621,608 tons
1897—220,496 tons	1895— 738,480 tons
1898—223,891 tons	1896— 329,068 tons
1899—263,869 tons	1897— 604,281 tons

1898— 700,990 tons	1895—245,883 tons
1899— 714,669 tons	1896—187,169 tons
1900— 666,389 tons	1897—166,122 tons
1901— 660,965 tons	1898—133,076 tons
1902—1,080,032 tons	1899—170,369 tons
Aurora	1900—193,111 tons
1884— 1,173 tons	1901—223,747 tons
1885— 4,249 tons	1902—402,981 tons
1886— 94,553 tons	Norrie Group
1887—159,252 tons	1903—1,145,711 tons
1888—179,937 tons	1904— 831,558 tons
1889—199,865 tons	1905—1,527,128 tons
1890—246,695 tons	1906—1,245,997 tons
1891— 83,554 tons	1907—1,109,085 tons
1892—319,482 tons	1908— 773,243 tons
1893—179,028 tons	1909— 977,054 tons
1894—203,152 tons	1910—1,333,006 tons
Total, Tons .....25,385,930	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Aurora:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
61.48	.035	6.25	.36						
Norrie:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
61.63	.034	5.98	.36						
Nordale:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
56.26	.044	11.65	.33						
Vaughn:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
61.35	.033	6.24	.36						
Norden:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
61.57	.088	6.90	.37						

The Ore in its natural state is as follows:

Aurora:				
Moist	Iron	Phos.	Silica	
11.39	54.48	.031	5.54	
Norrie:				
Moist	Iron	Phos.	Silica	
11.06	54.82	.030	5.32	
Nordale:				
Moist	Iron	Phos.	Silica	
11.06	50.04	.039	10.36	
Vaughn:				
Moist	Iron	Phos.	Silica	
11.81	54.11	.029	5.51	
Norden:				
Moist	Iron	Phos.	Silica	
11.63	54.41	.077	6.10	

OTTAWA MINE (formerly Odanah Mine).

Location: Iron County, Wisconsin, Section 27, Township 46, Range 2.

Description: First opened up in 1886. This mine ships three ores. OTTAWA and OTTAWA MANGANESE, soft, red, granular Bessemer Hematite; and ONTARIO, soft, red, granular. Non-Bessemer Hematite. Stoping system of mining is used. The greatest vertical depth is 632 feet. The ore is shipped via the Milwaukee, St. Paul & Sault Ste. Marie and the Chicago & Northwestern Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1886— 13,714 tons	1899—
1887— 30,475 tons	1900—
1888— 5,412 tons	1901—
1889— 13,354 tons	1902— 26,141 tons
1890— 1,065 tons	1903— 87,929 tons
1891—	1904— 30,420 tons
1892— 6,711 tons	1905— 21,986 tons
1893— 3,956 tons	1906— 57,219 tons
1894— 2,437 tons	1907— 46,424 tons
1895—	1908— 33,893 tons
1896—	1909— 100,223 tons
1897—	1910— 83,389 tons
1898—	

Total, Tons564,748

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Ottawa:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.99	.052	8.82	3.37	1.01	.27	.25	.011	5.06

Ottawa Manganese:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.79	.055	8.75	5.69	1.06	.18	.32	.009	5.66

Ontario:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.30	.068	9.67	2.36	1.17	.24	.19	.008	5.18

The Ore in its natural state is as follows:

Ottawa:

Moist	Iron	Phos.	Silica
8.74	51.10	.047	8.05

Ottawa Manganese:

Moist	Iron	Phos.	Silica	Mang.
8.50	49.22	.050	8.01	5.21

Ontario:

Moist	Iron	Phos.	Silica
8.30	51.63	.062	8.87

PURITAN MINE (formerly Ruby Mine).

Location: Gogebic County, Michigan, Section 17, Township 47, Range 46.

Description: First opened up in 1886. The ore is a dark reddish brown, hard and soft, Bessemer Hematite. Underground

system of mining is used. The greatest vertical depth is 1,264 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1886—	16,388 tons	1899—	
1887—	45,000 tons	1900—	
1888—	3,058 tons	1901—	21,788 tons
1889—	9,472 tons	1902—	
1890—	11,694 tons	1903—	
1891—	913 tons	1904—	1,259 tons
1892—		1905—	
1893—		1906—	
1894—		1907—	
1895—		1908—	
1896—		1909—	
1897—		1910—	50,019 tons
1898—			

Total, Tons159,591

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.76	.048	5.03	.62					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.02	54.59	.042	4.37

SUNDAY LAKE MINE.

Location: Gogebic County, Michigan, Section 10, Township 47, Range 45 West.

Description: First opened up in 1885. The mine ships two ores, SUNDAY LAKE, a Bessemer Hematite; and EARL, a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,020 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1885—	1,405 tons	1898—	
1886—	10,963 tons	1899—	12,526 tons
1887—	18,137 tons	1900—	74,097 tons
1888—		1901—	89,997 tons
1889—		1902—	144,630 tons
1890—	6,010 tons	1903—	91,383 tons
1891—	64,902 tons	1904—	50,625 tons
1892—	56,046 tons	1905—	79,209 tons
1893—	22,876 tons	1906—	86,879 tons
1894—	34,323 tons	1907—	101,899 tons
1895—	20,970 tons	1908—	111,130 tons
1896—	89,441 tons	1909—	93,712 tons
1897—	45,815 tons	1910—	115,486 tons

Total, Tons1,422,461

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Sunday Lake:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.70	.025	12.25	.45	.86	.21	.19	.007	.54

Earl:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.00	.085	12.70	.48	.84	.38	.27	.009	.70

The Ore in its natural state is as follows:

Sunday Lake:

Moist	Iron	Phos.	Silica
9.00	54.33	.023	11.15

Earl:

Moist	Iron	Phos.	Silica
7.00	54.87	.079	11.81

TILDEN MINE.

Location: Gogebic County, Michigan, Section 15, Township 47, Range 46.

Description: First opened up in 1891. Four ores are shipped from this mine: TILDEN and RAND, both dark, reddish brown hard and soft, Bessemer Hematite; and NORDEN and NORDEN No. 2, both hard and soft, dark, reddish brown, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,406 feet. The ore is shipped via the Milwaukee, St. Paul and Sault Ste. Marie and Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1891—28,415 tons	1901—446,670 tons
1892—233,356 tons	1902—468,672 tons
1893—135,118 tons	1903—211,534 tons
1894—209,077 tons	1904—204,581 tons
1895—418,188 tons	1905—188,104 tons
1896—250,205 tons	1906—169,697 tons
1897—276,890 tons	1907—312,496 tons
1898—287,203 tons	1908—111,184 tons
1899—500,830 tons	1909—154,506 tons
1900—481,909 tons	1910—99,937 tons

Total, Tons5,188,572

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Tilden:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.10	.044	3.96	.70					

Rand:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.79	.042	9.27	1.77					

Norden:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
62.37	.120	4.25	.55						

Norden No. 2:									
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss	
58.23	.094	10.03	.63						

The Ore in its natural state is as follows:

Tilden:			
Moist	Iron	Phos.	Silica
10.68	56.36	.039	3.54

Rand:			
Moist	Iron	Phos.	Silica
14.00	48.84	.036	7.98

Norden:			
Moist	Iron	Phos.	Silica
12.98	54.27	.104	3.70

Norden No. 2:			
Moist	Iron	Phos.	Silica
11.93	51.28	.083	8.84

YALE MINE (formerly West Colby Mine).

Location: Gogebic County, Michigan, Section 16, Township 47, Range 46.

Description: First opened up in 1901. The mine ships five ores, YALE, WOOLSEY and PORTER, all soft, red, Bessemer Hematite; and GLYUNA and HADLEY, both soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,780 feet. The ore is shipped via Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1901— 12,836 tons	1906— 56,657 tons
1902— 26,043 tons	1907— 38,010 tons
1903— 46,211 tons	1908— 14,874 tons
1904— 46,860 tons	1909— 71,458 tons
1905— 60,224 tons	1910— 108,253 tons
Total, Tons 481,426	

VERMILLION RANGE

CHANDLER MINE.

Location: St. Louis County, Minnesota, Section 28, Township 63, Range 12.

Description: First opened up in 1888. Two ores were shipped from this mine, CHANDLER, a Bessemer Hematite; and LONG LAKE, a Non-Bessemer Hematite. Underground system of mining was used. Greatest vertical depth 900 feet. The ore was shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat.

This mine was abandoned March 11th, 1909, after 20 years' operation in which it yielded nearly 10,000,000 tons of ore.

Yearly Shipments:

1888—454,612 tons	1899—808,359 tons
1889—306,220 tons	1900—644,801 tons
1890—336,002 tons	1901—627,379 tons
1891—373,969 tons	1902—645,786 tons
1892—651,655 tons	1903—460,548 tons
1893—435,930 tons	1904—422,162 tons
1894—558,050 tons	1905—365,739 tons
1895—605,024 tons	1906—318,990 tons
1896—471,545 tons	1907—245,684 tons
1897—438,365 tons	1908— 50,639 tons
1898—715,919 tons	1909—

Total, Tons9,537,378

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Chandler Ore:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.30	.048	7.53	.14					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.36	58.01	.046	7.12

PIONEER MINE.

Location: St. Louis County, Minnesota, Section 27, Township 63, Range 12.

Description: First opened up in 1889. The ore is a hard, red brown, Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,261 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors, and from there to the lower lake ports by boat.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1889—	3,144 tons	1900—	450,794 tons
1890—	12,012 tons	1901—	678,310 tons
1891—	3,079 tons	1902—	673,836 tons
1892—	2,651 tons	1903—	596,735 tons
1893—		1904—	505,432 tons
1894—		1905—	653,682 tons
1895—	40,054 tons	1906—	766,853 tons
1896—	149,073 tons	1907—	830,700 tons
1897—	204,103 tons	1908—	477,506 tons
1898—	123,183 tons	1909—	477,226 tons
1899—	339,897 tons	1910—	526,435 tons

Total, Tons7,517,732

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.35	.037	5.04	.10					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.18	60.07	.035	4.78

SAVOY MINE.

Location: St. Louis County, Minnesota, Section 26, Township 63, Range 12.

Description: First opened up in 1899. This mine ships Savoy Jura, a hard and soft, red brown, Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 857 feet. The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1899—	81,022 tons	1905—	91,775 tons
1900—	170,446 tons	1906—	106,933 tons
1901—	212,008 tons	1907—	43,320 tons
1902—	243,937 tons	1908—	82,521 tons
1903—	169,616 tons	1909—	83,167 tons
1904—	74,866 tons	1910—	59,875 tons

Total, Tons1,419,486

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.60	.038	4.99	.10					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.40	60.16	.036	4.72

SECTION 30 MINE.

Location: Lake County, Minnesota, Section 30, Lots 3, 5 and 6 S. E. $\frac{1}{4}$ of N. W. $\frac{1}{4}$, Township 63, Range 11 West.

Description: First opened up in 1908. Medium hard, brownish, red, Non-Bessemer, Hematite ore.

It is an underground mine. Greatest vertical depth 635 feet. The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat.

Sales Agents: Pickands, Mather & Co., Cleveland, O.,

Yearly Shipments:

1910— 51,650 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.10	.045	6.49	.12	1.52	.24	.22	.008	1.04

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.60	59.57	.042	6.13

SIBLEY MINE.

Location: St. Louis County, Minnesota, Sections 26 and 27, Township 63, Range 12.

Description: First opened up in 1899. Two ores are shipped from this mine, SIBLEY, a hard and soft, blue Bessemer Hematite; and SIBLEY JURA, a hard and soft, red brown Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,281 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1899—	5,169 tons	1905—	251,170 tons
1900—	4,670 tons	1906—	271,496 tons
1901—		1907—	226,835 tons
1902—	78,304 tons	1908—	127,544 tons
1903—	113,595 tons	1909—	151,009 tons
1904—	122,783 tons	1910—	206,386 tons

Total, Tons1,558,961

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Savoy Group:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
64.64	.042	3.95	.09					

Jura Grade:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
5.07	61.36	.040	3.75					
62.21	.086	5.34	.11					

The Ore in its natural state is as follows:

Savoy Group:

Moist	Iron	Phos.	Silica
5.07	61.36	.040	3.75

Jura Grade:

Moist	Iron	Phos.	Silica
5.20	58.98	.082	5.06

SOUDAN MINE.

Location: St. Louis County, Minnesota, Sections 27, 28, 32, 33 and 34, Township 62, Range 15.

Description: First opened up in 1884. This mine ships VERMILLION LUMP ORE, a hard, steel blue, Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,249 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1884—62,124 tons	1898—426,040 tons
1885—225,484 tons	1899—457,732 tons
1886—304,396 tons	1900—325,020 tons
1887—394,252 tons	1901—208,284 tons
1888—457,341 tons	1902—275,168 tons
1889—535,318 tons	1903—175,114 tons
1890—532,000 tons	1904—70,713 tons
1891—517,570 tons	1905—205,002 tons
1892—498,353 tons	1906—146,503 tons
1893—370,303 tons	1907—102,977 tons
1894—390,463 tons	1908—53,070 tons
1895—432,760 tons	1909—74,862 tons
1896—448,707 tons	1910—75,511 tons
1897—592,196 tons	

Total, Tons8,357,363

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.70	.177	6.05	.08					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
.94	63.10	.176	5.99

ZENITH MINE.

Location: St. Louis County, Minnesota, Section 27, Township 63, Range 12.

Description: First opened up in 1892. Three ores are shipped from this mine, ZENITH, a hard and soft, blue brown Bessemer Hematite; JURA and JURA LUMP, both blue brown Non-Bessemer Hematites.

It is an underground mine. Greatest vertical depth 1,100 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1892—	14,991 tons	1902—	167,205 tons
1893—	14,388 tons	1903—	161,091 tons
1894—		1904—	86,557 tons
1895—		1905—	109,818 tons
1896—	18,765 tons	1906—	181,580 tons
1897—	40,817 tons	1907—	235,751 tons
1898—		1908—	50,264 tons
1899—	79,323 tons	1909—	321,951 tons
1900—	60,089 tons	1910—	283,320 tons
1901—	60,082 tons		

Total, Tons1,885,992

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Jura:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
62.17	.091	5.21	.11					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.24	58.90	.086	4.94

MOOSE MOUNTAIN RANGE

MOOSE MOUNTAIN MINE.

Location: Hutton Township, Province of Ontario, Canada.

Description: The mine was first opened up in 1908. The ore is hard, steel blue, Non-Bessemer Magnetite. Open pit system of mining is used, the ore is blasted, trammed on surface to crushers, where it is crushed to pass a one-inch ring, and then concentrated in an electric concentrating plant.

The ore is shipped via the Canadian Northern Ontario Railway to Key Harbor on Georgian Bay and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1908— 2,557 tons	1910— 72,470 tons
1909— 28,556 tons	
Total, Tons .....103,583	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.83	.091	14.06	.06	1.92	3.82	3.64	.029	.63

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
.87	54.35	.090	13.94

BARABOO RANGE

ILLINOIS MINE.

Location: Sauk County, Wisconsin, Section 15 and 16, Township 11 North, Range 5 East.

Description: First opened up in 1904. The ore is soft, red, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 475 feet. Mine has been idle since 1908.

The ore is shipped via Chicago & Northwestern Railway to the furnace.

Owners: Illinois Iron Mining Co.

Yearly Shipments:

1904— 47,922 tons	1907— 72,180 tons
1905— 71,413 tons	1908— 51,108 tons
1906— 67,118 tons	
Total, Tons .....309,741	

MENOMINEE RANGE

ANTOINE MINE (Formerly Traders).

Location: Dickinson County, Michigan, Sections 17 and 20, Township 40 North, Range 30 West.

Description: First opened up in 1895. Two ores are shipped from this mine, CLIFFORD, a hard, grayish blue, silicious Bessemer, Semi-specular Hematite; and ANTOINE, a grayish blue, silicious, Non-Bessemer Semi-Specular Hematite. Open pit milling system of mining is used. The greatest vertical depth is 135 feet. The ore is crushed to three-inch size.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway or the Chicago & Northwestern Railway to Escanaba, and from there to the lower lake ports by boat.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1895— 27,931 tons	1903—107,886 tons
1896—110,821 tons	1904— 81,164 tons
1897— 98,847 tons	1905—138,395 tons
1898—104,510 tons	1906—195,855 tons
1899— 93,025 tons	1907—100,996 tons
1900—119,940 tons	1908—
1901— 63,429 tons	1909—
1902—110,993 tons	1910— 91,081 tons

Total, Tons1,444,873

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Clifford:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
39.25	.017	41.29	.18	.92	.57	.72	.016	1.00

Antoine:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
38.62	.030	42.13	.15	.95	.59	.75	.017	1.05

The Ore in its natural state is as follows:

Clifford:

Moist	Iron	Phos.	Silica
2.28	38.36	.017	40.35

Antoine:

Moist	Iron	Phos.	Silica
1.95	37.87	.029	41.31

ARAGON MINE.

Location: Dickinson County, Michigan, Sections 8 and 9, Township 39, Range 29.

Description: First opened up in 1899. There are three ores shipped from this mine, the GRANADA TOWNSITE and BRIER HILL, which are soft, blue, Non-Bessemer Hematites; and CADIZ, a hard, blue, Non-Bessemer Hematite. Underground method of mining is used. The greatest vertical depth is 1,083 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1889—	1,745 tons	1900—	404,645 tons
1890—	46,609 tons	1901—	477,212 tons
1891—	96,829 tons	1902—	646,203 tons
1892—	167,948 tons	1903—	522,035 tons
1893—	127,901 tons	1904—	374,944 tons
1894—	138,209 tons	1905—	423,698 tons
1895—	183,296 tons	1906—	431,000 tons
1896—	95,809 tons	1907—	441,636 tons
1897—	149,594 tons	1908—	226,354 tons
1898—	295,821 tons	1909—	246,984 tons
1899—	337,807 tons	1910—	241,046 tons
Total, Tons		6,077,325	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Granada:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.79	.061	7.12	.16					

Brier Hill:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.64	.054	8.09	.29					

Cadiz:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.16	.054	17.03	.17					

The Ore in its natural state is as follows:

Granada:

Moist	Iron	Phos.	Silica
7.74	55.16	.057	6.57

Brier Hill:

Moist	Iron	Phos.	Silica
5.18	51.81	.051	7.67

Cadiz:

Moist	Iron	Phos.	Silica
7.26	47.44	.051	15.80

ARMENIA MINE.

Location: Iron County, Michigan, Section 23, Township 43, Range 32.

Description: First opened up in 1889. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1889—	50,275 tons	1900—	
1890—	26,649 tons	1901—	18,750 tons
1891—		1902—	100,864 tons
1892—		1903—	31,901 tons
1893—		1904—	16,577 tons
1894—		1905—	
1895—	2,045 tons	1906—	27,882 tons
1896—		1907—	36,665 tons
1897—		1908—	
1898—		1909—	
1899—		1910—	65,473 tons
Total, Tons		377,081	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.32	.310	8.86	.54	2.66	1.37	.80	.005	3.20

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.60	51.24	.271	7.92

BAKER MINE.

Location: Iron County, Michigan, Section 31, Township 43, Range 34.

Description: First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1909—	45,003 tons	1910—	39,417 tons
Total, Tons		84,420	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.64	.348	7.67	.51	1.60	1.93	1.20	.008	4.70

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.75	51.68	.318	6.99

BALTIC MINE.

Location: Iron County, Michigan, Section 7, Township 42, Range 34 West.

Description: First opened up in 1901. The ore is a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 553 feet. The ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1901—17,326 tons	1906—186,495 tons
1902—64,664 tons	1907—189,119 tons
1903—123,236 tons	1908—129,037 tons
1904—151,114 tons	1909—174,426 tons
1905—133,246 tons	1910—171,930 tons

Total, Tons1,340,593

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.60	.456	7.96	.32	3.11	1.57	1.49	.048	4.94

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.50	50.32	.413	7.20

BERKSHIRE MINE.

Location: Iron County, Michigan, Section 6, Township 42, Range 34.

Description: First opened up in 1908. The ore is soft, red, Non-Bessemer Hematite. The caving system of mining is used. The greatest vertical depth is 365 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1908—3,440 tons	1910—97,999 tons
1909—34,295 tons	Total, Tons .....135,734

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.25	.720	10.25	.22	4.52	2.60	2.43	.046	3.05

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.44	46.97	.645	9.18

BREEN MINE.

Location: Dickinson County, Michigan, Section 22, Township 39, Range 28.

Description: Reopened in 1905. Waucedah ore is shipped from this mine. It is a hard, red, silicious Hematite. Open pit and milling system of mining is used. The greatest vertical depth is 258 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Prior to 1887—17,430 tons	1908—
1905—16,625 tons	1909—
1906—21,004 tons	1910—
1907—20,366 tons	Total, Tons .....75,425

Analysis: Expected analysis for season of 1911 is as follows:

Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
39.00	.016	41.53	.03	.89	.35	.80	.027	.60

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
3.00	37.83	.016	40.28

BRISTOL MINE (formerly Claire Mine).

Location: Iron County, Michigan, Section 19, Township 43, Range 32.

Description: First opened up in 1892. The mine ships two ores, BRISTOL and MANGANATE, both hard, brown, Non-Bessemer Hematites. The stoping system of mining is used. The greatest vertical depth is 900 feet. The ore is crushed to three inch size.

The ore is shipped via the Chicago & Northwestern Railway and the Chicago, Milwaukee & St. Paul Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1892—57,352 tons	1902—129,035 tons
1893—9,612 tons	1903—246,581 tons
1894—	1904—132,420 tons
1895—	1905—210,388 tons
1896—	1906—298,031 tons
1897—	1907—345,676 tons
1908—	1908—190,300 tons
1909—80,915 tons	1909—396,825 tons
1900—51,639 tons	1910—270,742 tons
1901—36,593 tons	

Total, Tons2,456,109

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bristol:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.86	.633	6.45	.74	2.83	2.77	1.54	.111	5.26

Manganate:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
50.36	.593	6.90	3.21	3.60	2.17	2.41	.055	7.72

The Ore in its natural state is as follows:

Bristol:

Moist	Iron	Phos.	Silica
7.80	50.58	.584	5.95

Manganate:

Moist	Iron	Phos.	Silica
7.63	46.52	.548	6.37

BUCKEYE MINE.

Location: Florence County, Wisconsin, Section 9, Township 39, Range 19.

Description: First opened up in 1909. The ore is a lumpy, red, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 300 feet. The ore is passed over a grizzly and the lumps are sledged.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1910— 89,116 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
52.40	.436	10.75	.13	2.75	2.22	2.51	.196	6.50

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.00	48.21	.401	9.89

CALUMET MINE.

Location: Dickinson County, Michigan, Section 8, Township 41, Range 23 West.

Description: Reopened in 1906. The ore is a silicious Hematite. Underground system of mining is used. The greatest vertical depth is 215 feet. The ore is crushed.

The ore is shipped via the C. & N. W. Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Prior to 1894— 38,713

1906— 15,773 tons

1907— 51,646 tons

1908— 15,222 tons

1909—

Total, Tons121,354

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.75	.023	34.67	.20	2.23	.72	.96	.009	1.46

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
4.50	39.87	.022	33.11

CASPIAN MINE.

Location: Iron County, Michigan, Section 1, Township 42, Range 35 West.

Description: The mine was first opened up in 1903. This mine ships BALTIC ore, which is a Non-Bessemer Hematite. Underground method of mining is used. The greatest vertical depth is 292 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1903—	2,088 tons	1907—	138,867 tons
1904—	4,242 tons	1908—	102,628 tons
1905—	10,248 tons	1909—	189,023 tons
1906—	80,875 tons	1910—	171,334 tons
Total, Tons.....		699,305	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.60	.456	7.96	.32	3.11	1.57	1.49	.048	4.94

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.50	50.32	.413	7.20

CHAPIN MINE.

Location: Dickinson County, Michigan, Sections 25 and 30, Township 40, Range 31 and 30.

Description: First opened up in 1880. Two ores are shipped from this mine, CHAPIN and AJAX, both ores are soft, blue, Non-Bessemer Hematites. It is an underground mine. The greatest vertical depth is 1,522 feet.

The ore is shipped via the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern Railways to Escanaba, and from there by boat to the lower lake ports.

This mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1880—	34,556 tons	1889—	518,990 tons
1881—	134,521 tons	1890—	742,843 tons
1882—	247,506 tons	1891—	488,749 tons
1883—	265,830 tons	1892—	660,052 tons
1884—	290,972 tons	1893—	489,134 tons
1885—	157,455 tons	1894—	235,895 tons
1886—	198,871 tons	1895—	618,589 tons
1887—	336,128 tons	1896—	420,318 tons
1888—	290,871 tons	1897—	643,402 tons

1898—724,768 tons	1905—902,628 tons
1899—940,513 tons	1906—943,425 tons
1900—929,937 tons	1907—855,308 tons
1901—929,701 tons	1908—391,620 tons
1902—956,812 tons	1909—587,647 tons
1903—704,051 tons	1910—465,543 tons
1904—541,324 tons	

Total, Tons17,649,477

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Chapin:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.97	.065	6.44	.35					

Ajax:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.73	.055	14.70	.33					

The Ore in its natural state is as follows:

Chapin:

Moist	Iron	Phos.	Silica	Mang.
7.16	53.82	.060	5.98	.32

Ajax:

Moist	Iron	Phos.	Silica	Mang.
6.83	48.20	.052	13.69	.31

CHATHAM MINE.

Location: Iron County, Michigan, Section 35, Township 43, Range 35.

Description: First opened up in 1907. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 500 feet. The ore is passed over a grizzly and the lumps are sledged.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1907— 14,833 tons	1909— 68,730 tons
1908— 45,826 tons	1910— 51,988 tons

Total, Tons181,427

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.94	.328	11.12	.18	2.00	.82	.98	1.39	6.47

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
5.74	50.84	.309	10.48

CRYSTAL FALLS MINE.

Location: Iron County, Michigan, Section 21, Township 43, Range 32.

Description: First opened up in 1882. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway and the Chicago, Milwaukee & St. Paul Railway to Escanaba, and from there by boat to the lower lake ports.

Yearly Shipments:

Prior to 1895—5,315 tons	1903—117,096 tons
1895—13,037 tons	1904—180,983 tons
1896—44,526 tons	1905—152,255 tons
1897—95,210 tons	1906—111,871 tons
1898—128,233 tons	1907—114,158 tons
1899—147,346 tons	1908—296 tons
1900—197,770 tons	1909—986 tons
1901—230,614 tons	1910—
1902—195,555 tons	

Total, Tons1,735,251

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Analysis: Expected analysis for season of 1911 is as follows:

Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.70	.616	7.60	.69	1.73	2.35	1.90	.006	3.40

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.68	51.78	.562	6.94

CYCLOPS AND NORWAY MINE.

Location: Dickinson County, Michigan, Section 5, Township 39, Range 29.

Description: First opened up in 1878. The mine ships five ores, the CYCLOPS and VULCAN are medium hard, blue and brown, Bessemer, red Hematites; HARPER, a medium hard, blue and brown, Non-Bessemer red Hematite; JUPITER, a medium hard, blue and brown, silicious Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The open pit, milling and underhand caving systems of mining are used. The greatest vertical depth is 355 feet.

The ore is shipped via the Chicago & Northwestern and Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Owners: Penn. Iron Mining Co.

Yearly Shipments:

Cyclops	1885—49,897 tons
1878—6,275 tons	1886—37,189 tons
1879—46,472 tons	1887—14,297 tons
1880—14,368 tons	1888—14,693 tons
1881—12,214 tons	1889—6,101 tons
1882—18,287 tons	1890—7,361 tons
1883—22,675 tons	1891—10,599 tons
1884—24,099 tons	1892—1,697 tons

Total, Tons286,093

Norway	1885—	67,741 tons
1878— 7,533 tons	1886—	93,878 tons
1879— 73,590 tons	1887—	95,726 tons
1880—198,165 tons	1888—	87,260 tons
1881—137,558 tons	1889—	68,044 tons
1882—165,084 tons	1890—	61,717 tons
1883—114,836 tons	1891—	4,089 tons
1884— 71,515 tons	1892—	44,767 tons
Total, Tons	1,291,352	

Penn Iron Mining Co.

1893—280,450 tons	1902—273,443 tons
1894—175,274 tons	1903—343,543 tons
1895—290,622 tons	1904—141,948 tons
1896—179,917 tons	1905—423,244 tons
1897—237,886 tons	1906—496,582 tons
1898—223,713 tons	1907—381,128 tons
1899—229,651 tons	1908—176,211 tons
1900—197,606 tons	1909—428,004 tons
1901—538,126 tons	1910—344,760 tons
Total, Tons.....	8,845,135

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Cyclops:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.35	.015	9.77	.07	2.16	.81	1.26	.048	

Vulcan:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.38	.055	11.72	.01	2.30	.76	1.57	.054	

Jupiter:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.81	.017	33.32		2.95	.69	.88	.050	

Harper:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulp.	Loss
59.95	.100	7.33	.11	1.38	1.13	2.27	.033	2.05*

The Ore in its natural state is as follows:

Cyclops:

Moist	Iron	Phos.	Silica
7.37	56.11	.014	9.05

Vulcan:

Moist	Iron	Phos.	Silica
7.58	54.68	.051	10.83

Jupiter:

Moist	Iron	Phos.	Silica
5.92	39.52	.016	31.35

Harper:

Moist	Iron	Phos.	Silica
5.70	56.53	.094	6.91

DAVIDSON NO. 1 MINE.

Location: Iron County, Michigan, Section N. E. $\frac{1}{4}$ -N. W. $\frac{1}{4}$ 23, Township 43, Range 35.

Description: This mine will be opened up in 1911. The ore is Non-Bessemer Hematite. The greatest vertical depth is 450 feet.

The ore will be shipped via the Chicago & Northern Railway to Escanaba, and from there by boat to the lower lake ports.

Owners: Davidson Ore Mining Co.

Expected Analysis for 1911:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulp.	Loss
56.90	.595	2.88	.35	2.78	.45	.40	.056	10.90
Moist	Iron	Phos.	Silica					
7.50	52.63	.550	2.66					

DAVIDSON NO. 2 MINE.

Location: Iron County, Michigan, W. $\frac{1}{2}$ S. E. $\frac{1}{4}$ Section 14, Township 43, Range 35.

Description: This mine will be opened up in 1911. The ore is a Non-Bessemer Hematite. The greatest vertical depth is 150 feet.

The ore will be shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Owners: Davidson Ore Mining Co.

DUNN MINE.

Location: Iron County, Michigan, Section 1, Township 42, Range 33.

Description: First opened up in 1887. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1887— 24,677 tons	1899— 7,458 tons
1888—118,096 tons	1900—
1889—151,828 tons	1901—
1890—156,963 tons	1902— 2,816 tons
1891—162,721 tons	1903— 5,365 tons
1892—133,666 tons	1904—
1893— 58,590 tons	1905— 21,051 tons
1894— 24,538 tons	1906— 91,476 tons
1895— 90,885 tons	1907—141,992 tons
1896— 47,081 tons	1908— 8,829 tons
1897— 31,062 tons	1909—193,396 tons
1898— 49,381 tons	1910—136,144 tons

Total, Tons1,658,015

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.10	.590	6.47	.70	1.91	2.58	2.10	.007	3.05

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.15	52.45	.542	5.94

EAST VULCAN MINE.

Location: Dickinson County, Michigan. Sections 10 and 11, Township 39, Range 29.

Description: First opened up in 1877. Five ores are shipped from this mine, CYCLOPS and VULCAN, medium hard, blue and brown Bessemer, red Hematite; HARPER, medium hard, blue and brown, Non-Bessemer, red Hematite; JUPI-TER, medium hard, blue and brown, silicious Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The mine is worked by rooms and pillars with square set timbering, by the caving and underhand stoping systems. The greatest vertical depth is 1,400 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Owners: Penn Iron Mining Co.

See Cyclops and Norway Mines for Analysis.

Yearly Shipments:

1877—	4,593 tons
1878—	31,129 tons
1879—	57,350 tons
1880—	72,405 tons
1881—	85,671 tons
1882—	94,042 tons
1883—	79,874 tons
1884—	101,722 tons
1885—	124,120 tons
1886—	143,930 tons

1887—	205,036 tons
1888—	129,541 tons
1889—	153,900 tons
1890—	104,996 tons
1891—	78,967 tons
1892—	179,904 tons

After 1892 this ore was reported under shipments from Penn Iron Mining Co.

Total, Tons1,668,654

FAIRBANKS MINE, OR PAINT RIVER MINE.

Location: Iron County, Michigan, Section 20, Township 43, Range 32.

Description: First opened up in 1882. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1882—	6,515 tons	1897—	
1883—	5,873 tons	1898—	
1884—	11,652 tons	1899—	
1885—	2,373 tons	1900—	1,316 tons
1886—	13,933 tons	1901—	
1887—	10,240 tons	1902—	10,383 tons
1888—	12,506 tons	1903—	9,863 tons
1889—	32,700 tons	1904—	11,257 tons
1890—	62,654 tons	1905—	11,973 tons
1891—	45,435 tons	1906—	28,321 tons
1892—	18,390 tons	1907—	75,805 tons
1893—		1908—	
1894—		1909—	
1895—		1910—	
1896—			

Total, Tons379,789

Analysis: Expected analysis for season of 1911 is as follows:

Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.85	5.80	6.93	.85	1.87	2.25	1.95	.009	3.70

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.55	51.42	.524	6.27

FLORENCE MINE.

Location: Florence County, Wisconsin, Sections 20 and 21, Township 40, Range 18.

Description: First opened up in 1880. The ore is a medium hard, red and brown, Non-Bessemer Hematite. Milling and stoping systems of mining are used. The greatest vertical depth is 700 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1880—	14,143 tons	1896—	35,136 tons
1881—	100,501 tons	1897—	37,594 tons
1882—	160,155 tons	1898—	93,663 tons
1883—	40,232 tons	1899—	74,235 tons
1884—		1900—	35,756 tons
1885—		1901—	15,395 tons
1886—	8,210 tons	1902—	130,798 tons
1887—	79,399 tons	1903—	95,877 tons
1888—	142,585 tons	1904—	153,452 tons
1889—	196,269 tons	1905—	233,858 tons
1890—	218,570 tons	1906—	169,459 tons
1891—	48,806 tons	1907—	178,955 tons
1892—	48,246 tons	1908—	140,354 tons
1893—	9,634 tons	1909—	231,191 tons
1894—	2,726 tons	1910—	239,161 tons
1895—	22,820 tons		

Total, Tons2,957,180

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron.	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.80	.269	6.43	.18	3.91	2.14	3.01	1.85	4.77

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.02	49.31	.242	5.79

FOGARTY MINE.

Location: Iron County, Michigan, Section 1, Township 42, Range 35 West.

Description: First opened up in 1907. BALTIC ore, which is a Non-Bessemer Hematite, is shipped from this mine. Underground system of mining is used. The greatest vertical depth is 255 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907—	7,949 tons	1909—	77,356 tons
1908—	32,560 tons	1910—	51,071 tons
Total, Tons 1,68,936			

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.60	.456	7.96	.32	3.11	1.57	1.49	.048	4.94

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.50	50.32	.413	7.20

GENESEE MINE.

Location: Iron County, Michigan, Section 29-30-31, Township 43, Range 32 West.

Description: First opened up in 1902. The ore is soft, red. Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1902—	14,455 tons	1907—	38,984 tons
1903—	61,694 tons	1908—	
1904—	132,380 tons	1909—	65,585 tons
1905—	77,370 tons	1910—	66,185 tons
1906—	80,971 tons		
Total, Tons		537,624	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.08	.587	7.33	.35	2.12	2.63	2.55	.008	2.88

The Ore in its natural state is as follows:

Moist Iron	Phos.	Silica
8.65	52.14	.536 6.70

GREAT WESTERN MINE.

Location: Iron County, Michigan, Section 21, Township 43, Range 32.

Description: First opened up in 1882. Two ores are shipped from this mine, GREAT WESTERN and BASIC, both soft, brown, Non-Bessemer Hematite. The ore is crushed. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1882—	587 tons	1897—	
1883—	22,825 tons	1898—	33,851 tons
1884—	20,710 tons	1899—	43,316 tons
1885—		1900—	98,550 tons
1886—	22,267 tons	1901—	123,261 tons
1887—	23,239 tons	1902—	42,470 tons
1888—	21,860 tons	1903—	100,751 tons
1889—	38,454 tons	1904—	68,318 tons
1890—	72,546 tons	1905—	191,265 tons
1891—	62,464 tons	1906—	311,218 tons
1892—	87,487 tons	1907—	234,492 tons
1893—	661 tons	1908—	124,246 tons
1894—		1909—	112,747 tons
1895—		1910—	80,709 tons
1896—	14,643 tons		

Total, Tons1,952,937

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Great Western:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.00	.517	6.89	.74	2.90	2.98	2.12	.043	3.16

Basic:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
50.50	.420	6.12	.42	4.80	2.57	3.64	2.93	.091

The Ore in its natural state is as follows:

Great Western:

Moist Iron	Phos.	Silica
8.35	50.41	.474 6.31

Basic:

Moist Iron	Phos.	Silica
8.35	46.28	.385 5.61

GROVELAND MINE.

Location: Dickinson County, Michigan, N. E. $\frac{1}{4}$ of S. E. $\frac{1}{4}$ and N. E. $\frac{1}{4}$ of S. W. $\frac{1}{4}$, Section 31, Township 42, Range 29.

Description: First opened up in 1901. The ore is hard, grey, low grade Bessemer Hematite. Milling, overhead and underhand stoping systems of mining are used. The greatest vertical depth is 186 feet. The ore was crushed in 1910. The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Company, Cleveland.

Yearly Shipments:

Prior to 1901—1,049 tons	1906—
1901—11,444 tons	1907—13,913 tons
1902—7,599 tons	1908—9,123 tons
1903—1,294 tons	1909—24,933 tons
1904—4,737 tons	1910—26,462 tons
1905—	

Total, Tons100,554

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
46.35	.039	19.54	1.04	2.06	2.81	3.86	.011	3.86

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
2.56	45.16	.038	19.04

HEMLOCK MINE.

Location: Iron County, Michigan, Section 4, Township 44, Range 33 West.

Description: First opened up in 1889. The ore is Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 935 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1889—	1900—72,413 tons
1890—	1901—149,966 tons
1891—35,531 tons	1902—123,331 tons
1892—65,459 tons	1903—79,420 tons
1893—11,323 tons	1904—136,232 tons
1894—	1905—124,450 tons
1895—949 tons	1906—106,437 tons
1896—94,645 tons	1907—117,181 tons
1897—96,032 tons	1908—83,834 tons
1898—69,865 tons	1909—112,481 tons
1899—110,269 tons	1910—115,407 tons

Total, Tons1,705,225

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
52.50	.196	4.42	.40	2.53	5.64	3.68	.016	7.69

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
2.80	51.03	.191	4.30

HIAWATHA MINE.

Location: Iron County, Michigan, Section 35, Township 43 North, Range 35 West.

Description: First opened up in 1893. The ore is medium hard, red, Non-Bessemer Hematite. The sub-level stoping system of mining is used. The greatest vertical depth is 665 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Rogers, Brown Iron Co., Buffalo, N. Y.

Yearly Shipments:

1893—	1,683 tons	1902—	74,596 tons
1894—		1903—	53,828 tons
1895—	1,201 tons	1904—	38,288 tons
1896—		1905—	9,704 tons
1897—		1906—	20 tons
1898—		1907—	
1899—		1908—	138,190 tons
1900—	11,008 tons	1909—	136,739 tons
1901—	20,355 tons	1910—	128,884 tons
Total, Tons		614,496	

HOLLISTER MINE.

Location: Iron County, Michigan, Section 13, Township 43, Range 33 West.

Description: First opened up in 1890. The ore is soft, red, Non-Bessemer Hematite. Stoping system of mining is used. The greatest vertical depth is 500 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Hollister Mining Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1890—	2,020 tons	1907—	6,371 tons
1891—	1,057 tons	1908—	10,671 tons
1892—	1,021 tons	1909—	25,842 tons
1893-1906—		1910—	49,434 tons
Total, Tons		96,416	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.50	1.021	11.00	1.12	1.53	4.36	.38	.039	1.02

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
6.00	51.23	.960	10.34

KASECO MINE (Formerly Konwinski).

Location: Iron County, Michigan, Section 23, Township 43, Range 35.

Description: First opened up in 1906. The mine ships JAMES ore, a soft, yellow, Non-Bessemer Hematite. Sub-level caving system of mining is used. The greatest vertical depth is 301 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1910— 78,388 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.50	.488	8.73	.22	1.13	.46	.22	.017	8.72

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.00	51.06	.449	8.03

KIMBALL MINE.

Location: Iron County, Michigan, Section 29, Township 43, Range 32.

Description: First opened up in 1906. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1907—	16,224 tons	1909—
1908—		1910—

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.95	.610	8.56	.65	2.63	2.25	2.15	.006	2.95

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.40	51.25	.556	7.84

LAMONT MINE.

Location: Iron County, Michigan, Section 20, Township 43, Range 32.

Description: First opened up in 1889. The ore is a soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Yearly Shipments:

1889—	12,348 tons	1900—	31,323 tons
1890—	31,139 tons	1901—	
1891—	26,226 tons	1902—	47,267 tons
1892—	42,819 tons	1903—	43,736 tons
1893—	13,777 tons	1904—	29,393 tons
1894—	2,600 tons	1905—	74,991 tons
1895—		1906—	89,980 tons
1896—		1907—	42,090 tons
1897—		1908—	
1898—		1909—	
1899—	67,652 tons	1910—	3,183 tons
Total, Tons.....		558,524	

LINCOLN MINE.

Location: Iron County, Michigan, Section 21, Township 43, Range 32 West.

Description: First opened up in 1891. The ore is a soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1891— 1,813 tons	1903— 15,606 tons
1892— 26,019 tons	1904— 17,577 tons
1893— 8,757 tons	1905— 19,539 tons
1894—1898—	1906— 5,890 tons
1899— 43,622 tons	1907— 714 tons
1900— 72,959 tons	1908—
1901— 19,727 tons	1909— 1,657 tons
1902— 7,747 tons	1910—
Total, Tons .....241,627	

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.76	.469	6.20	.77	2.83	2.33	2.37	.009	3.14

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.56	51.90	.429	5.67

LORETTO MINE.

Location: Dickinson County, Michigan, Section 7, Township 39, Range 28.

Description: First opened up in 1892. Three ores are shipped from this mine, RUSSELL and RUSSELL SPECIAL, soft, blue, Non-Bessemer Hematite; and SAN JOSE, a soft, blue, Bessemer Hematite. Top slicing system of mining is used. Greatest vertical depth is 800 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1893— 8,131 tons	1902—128,300 tons
1894— 55,983 tons	1903— 87,939 tons
1895— 53,160 tons	1904— 54,720 tons
1896— 34,334 tons	1905—118,738 tons
1897— 54,104 tons	1906—140,390 tons
1898— 68,447 tons	1907— 99,779 tons
1899— 64,824 tons	1908— 13,354 tons
1900— 61,219 tons	1909— 96,613 tons
1901— 54,985 tons	1910—116,048 tons
Total, Tons.....:1,311,068	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Russell:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.04	.053	10.25	.27	2.82	2.10	3.85	.006	4.42

Russell Special:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
47.40	.059	18.02	.16	2.63	1.35	2.33	.005	3.81

The Ore in its natural state is as follows:

Russell:

Moist	Iron	Phos.	Silica
7.40	49.12	.049	9.49

Russell Special:

Moist	Iron	Phos.	Silica
7.40	43.89	.055	16.69

MANSFIELD MINE.

Location: Iron County, Michigan, Section 17 and 20, Township 43, Range 31.

Description: First opened up in 1890. The mine ships CLEARFIELD ore, a hard, brown, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,189 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1890—	18,303 tons	1901—	74,113 tons
1891—	49,836 tons	1902—	31,181 tons
1892—	69,259 tons	1903—	51,440 tons
1893—	69,558 tons	1904—	79,163 tons
1894—		1905—	38,584 tons
1895—		1906—	
1896—		1907—	183,532 tons
1897—	37,182 tons	1908—	44,633 tons
1898—	60,739 tons	1909—	118,713 tons
1899—	86,607 tons	1910—	114,357 tons
1900—	90,155 tons		

Total, Tons1,217,355

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Clearfield:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.19	.119	5.30	.18					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.72	51.63	.108	4.78

MCDONALD MINE.

Location: Iron County, Michigan, S. E. ¼ of N. E. ¼ Section 23, Township 43, Range 32.

Description: First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Milling and caving systems of mining are used. The greatest vertical depth is 240 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Co., Cleveland.

Yearly Shipments:

1909—	1,144 tons	1910—	6,022 tons
Total, Tons		7,166	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.00	.10	6.00	.30	2.50				

MICHIGAN MINE.

Location: Iron County, Michigan, Section 9, Township 44, Range 33.

Description: First opened up in 1893. This mine ships MICHIGAN No. 1 ore, a hard, yellowish brown, Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 541 feet.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1893—	505 tons	1902—	53,272 tons
1894—	77 tons	1903—	
1895—	1,071 tons	1904—	
1896—		1905—	58,088 tons
1897—	216 tons	1906—	146 tons
1898—		1907—	39,819 tons
1899—		1908—	603 tons
1900—		1909—	
1901—		1910—	17,922 tons
Total, Tons.....		171,719	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Michigan No. 1:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.72	.193	10.54	.21					

The Ore in its natural state is as follows:

Michigan No. 1:

Moist	Iron	Phos.	Silica
9.00	50.71	.175	9.59

MILLIE MINE. (Formerly Hewitt Mine).

Location: Dickinson County, Michigan, Section 31, Township 40, Range 34 West.

Description: First opened up in 1880. Two ores are shipped from this mine, ALGOMA, a soft, blue, Bessemer Hematite; and DAVY, a hard, blue, silicious Hematite. The sub-level

back stope and open cut mining systems are used. The greatest vertical depth is 600 feet. The Davy ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1881—	4,352 tons	1896—	21,815 tons
1882—	9,500 tons	1897—	10,374 tons
1883—	7,516 tons	1898—	17,430 tons
1884—	7,927 tons	1899—	15,194 tons
1885—	4,627 tons	1900—	14,922 tons
1886—	5,517 tons	1901—	12,133 tons
1887—	1,163 tons	1902—	25,935 tons
1888—	11,124 tons	1903—	40,860 tons
1889—	12,274 tons	1904—	
1890—	39,232 tons	1905—	
1891—	5,889 tons	1906—	36,815 tons
1892—	6,780 tons	1907—	18,691 tons
1893—		1908—	3,322 tons
1894—	13,062 tons	1909—	10,887 tons
1895—	10,924 tons	1910—	

Total, Tons368,267

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Algoma:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.60	.045	8.30	.17	1.09	2.15	1.98	.041	2.40

Davy:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
40.55	.027	36.25	.15	.82	.98	1.07	.012	2.10

The Ore in its natural state is as follows:

Algoma:

Moist	Iron	Phos.	Silica
4.26	56.10	.043	7.95

Davy:

Moist	Iron	Phos.	Silica
1.50	39.94	.027	35.71

MUNRO MINE.

Location: Dickinson County, Michigan. Section 6, Township 39 North, Range 29 West.

Description: First opened up in 1903. The ore is hard, red, silicious Hematite. Open pit system of mining is used. The greatest vertical depth is 141 feet. The ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there to the lower lake ports by boat.

Sales Agents: Rogers-Brown Iron Co., Buffalo, N. Y.

Yearly Shipments:

1903—	8,739 tons	1907—	46,834 tons
1904—	32,332 tons	1908—	27,773 tons
1905—	92,183 tons	1909—	23,241 tons
1906—	47,454 tons	1910—	20,022 tons
Total, Tons.....		298,578	

NANAIMO MINE.

Location: Iron County, Michigan, Section 26, Township 43 Range 35.

Description; First opened up in 1882. The mine ships JAMES ore, a soft, yellow, Non-Bessemer Hematite. Sub-level caving system of mining is used. The greatest vertical depth is 362 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Beta		1889—	
1886—	1,585 tons	1890—	
1887—	1,226 tons	1891—	1,400 tons
1888—			
Total, Tons		4,211	
Nanaimo		1890—	3,441 tons
1882—	2,480 tons	1891—	13,200 tons
1883—	29,221 tons	1904—	9,086 tons
1884—	37,620 tons	1905—	91,238 tons
1885—		1906—	91,792 tons
1886—	5,400 tons	1907—	53,778 tons
1887—	30,460 tons	1908—	305 tons
1888—	5,744 tons	1909—	
1889—		1910—	
Total, Tons		373,765	

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

James:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.50	.488	8.73	.22	1.13	.46	.22	.017	8.72

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.00	51.06	.449	8.03

OSANA MINE (Formerly James).

Location: Iron County, Michigan, Section 23, Township 43, Range 35.

Description: Re-opened in 1906. This mine ships JAMES ore, which is a soft, yellow, Non-Bessemer Hematite. Sub-level

caving system of mining is used. The greatest vertical depth is 428 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907—	2,360 tons	1909—	90,851 tons
1908—	59,760 tons	1910—	78,388 tons
Total, Tons.....231,359			

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

James:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.50	.488	8.73	.22	1.13	.46	.22	.017	8.72

The Ore in its natural state is as follows:

James:

Moist	Iron	Phos.	Silica
8.00	51.06	.449	8.03

PEWABIC MINE.

Location: Dickinson County, Michigan, Section 32, Township 40, Range 30.

Description: First opened up in 1887. There are five ores shipped from this mine, PEWABIC, a soft, blue, Bessemer Hematite; TOLEDO, a hard, red, high grade, silicious Hematite; GENOA, hard, red, silicious Hematite; WALPOLE, a soft, blue, Non-Bessemer Hematite; and TYRONE, a soft, blue, Bessemer Hematite. The sub-level and block caving system of mining is used. The greatest vertical depth is 941 feet. The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1890—	26,991 tons	1901—	507,786 tons
1891—	64,507 tons	1902—	530,291 tons
1892—	115,273 tons	1903—	489,175 tons
1893—	165,745 tons	1904—	372,791 tons
1894—	304,010 tons	1905—	533,413 tons
1895—	262,551 tons	1906—	493,891 tons
1896—	273,587 tons	1907—	457,796 tons
1897—	279,855 tons	1908—	365,341 tons
1898—	305,072 tons	1909—	465,453 tons
1899—	530,129 tons	1910—	380,376 tons
1900—	374,043 tons		

Total, Tons.....7,317,165

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Pewabic:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.80	.012	10.38	.12	1.04	.74	1.12	.006	1.31

Toledo:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
48.10	.014	25.78	.09	1.40	.89	1.35	.015	1.79
Pewabic Genoa:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
38.85	.012	39.34	.07	1.49	.58	1.48	.009	1.48
Walpole:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.30	.074	7.01	.18	1.66	1.99	3.16	.005	3.93
Tyrone:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.65	.030	11.56	.10	.83	1.66	1.75	.007	3.08

The Ore in its natural state is as follows:

Walpole:			
Moist	Iron	Phos.	Silica
7.31	53.11	.0686	6.498

QUINNESEC MINE.

Location: Dickinson County, Michigan, Section 34, Township 40, Range 30.

Description: First opened up in 1878. The ore is a soft, blue silicious Bessemer Hematite. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1878—25,925 tons	1895—
1879—41,954 tons	1896—
1880—52,436 tons	1897—
1881—43,711 tons	1898—
1882—44,240 tons	1899—11,049 tons
1883—21,676 tons	1900—25,967 tons
1884—16,995 tons	1901—66,383 tons
1885—14,110 tons	1902—62,770 tons
1886—13,442 tons	1903—49,447 tons
1887—6,585 tons	1904—
1888—2,249 tons	1905—
1889—	1906—
1890—	1907—
1891—	1908—1,409 tons
1892—	1909—3,147 tons
1893—	1910—744 tons
1894—	

Total, Tons.....627,215

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
40.70	.032	37.40	.07	1.05	1.45	.77	.006	.95

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
3.20	39.40	.031	36.20

RANDVILLE MINE.

Location: Dickinson County, Michigan, Section 31, Township 42 North, Range 29 West.

Description: The mine is at present an exploration. The ore is hard, blue silicious Hematite.

The ore is shipped via the C. M. & St. P. Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co., Cleveland.

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
42.70	.024	36.24	.15	.42	.40	.25	.006	1.00

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
4.00	40.99	.023	34.79

RIVERTON MINE.

Location: Iron County, Michigan, Sections 1, 35 and 36, Townships 42 and 43, Range 35.

Description: First opened up in 1898. The mine ships the BARTON ore, a hard, yellowish brown, Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 696 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Barton:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.20	.611	6.12	.21					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
7.64	51.91	.564	5.65

Yearly Shipments:

1898—	5,009 tons	1905—	82,611 tons
1899—	13,242 tons	1906—	161,704 tons
1900—	120,207 tons	1907—	90,358 tons
1901—	119,860 tons	1908—	47,073 tons
1902—	215,850 tons	1909—	171,200 tons
1903—	97,633 tons	1910—	84,269 tons
1904—	81,543 tons		

Total, Tons.....2,195,146

TOBIN MINE.

Location: Iron County, Michigan, Section 30, Township 43, Range 32.

Description: First opened up in 1901. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1901—18,957 tons	1906—235,867 tons
1902—55,238 tons	1907—237,781 tons
1903—54,386 tons	1908—161,642 tons
1904—113,669 tons	1909—359,668 tons
1905—166,529 tons	1910—235,812 tons
Total, Tons .....1,630,549	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.05	.595	6.82	.32	1.69	2.90	2.68	.007	2.83

The Ore in its natural state is as follows:

Moist Iron	Phos.	Silica
8.28	52.33	.546 6.25

TULLY MINE.

Location: Iron County, Michigan, Section 36, Township 43, Range 35 West.

Description: First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1910—2,726 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.72	.516	7.95	.42	1.73	2.09	1.56	.007	4.32

The Ore in its natural state is as follows:

Moist Iron	Phos.	Silica
8.91	51.67	.470 7.24

VIVIAN MINE.

Location: Dickinson County, Michigan, Section 34, Township 40, Range 30 West.

Description: First opened up in 1902. The ore is a silicious Hematite. Underground system of mining is used. The greatest vertical depth is 310 feet. The ore is crushed.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1902— 40,384 tons	1907— 48,493 tons
1903— 12,122 tons	1908— 10,056 tons
1904— 81,354 tons	1909—
1905— 90,426 tons	1910— 14,827 tons
1906—122,577 tons	

Total, Tons420,239

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
37.60	.016	40.82	.05	1.18	1.15	1.29	.009	1.72

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
3.00	36.47	.016	39.60

WEST VULCAN, CURRY AND BRIER HILL MINES.

Location: Dickinson County, Michigan, Section 9 and 10, Township 39, Range 29.

Description: First opened up in 1877. There are five ores shipped from these mines, CYCLOPS and VULCAN, medium hard, blue and brown, Bessemer, red Hematites; HARPER, a medium hard, blue and brown, Non-Bessemer, red Hematite; JUPITER, a medium hard, blue and brown, silicious, Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The mines are worked under the following systems: Caving, underhand stoping, and rooms and pillars with square set timbering. The greatest vertical depth is 1,500 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Owners: Penn Iron Mining Co.

Yearly Shipments:

Prior to 1893, reported separately as Vulcan, Norway, Cyclops and Curry, a total of 3,663,027 tons. After 1893 shipments reported under the heading of Penn Iron Mining Co. See Cyclops and Norway Mines.

See Cyclops and Norway Mines for Analysis.

YOUNGS MINE.

Location: Iron County, Michigan, E. $\frac{1}{2}$ of Section 12, Township 42, Range 35.

Description: First opened up in 1905. The ore is hard, red, Non-Bessemer Hematite. The milling and underhand stoping systems of mining are used. The greatest vertical depth is 419 feet. The ore will be crushed this year.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Co., Cleveland.

Yearly Shipments:

1905— 10,926 tons	1908— 70,094 tons
1906— 47,583 tons	1909—154,150 tons
1907— 92,632 tons	1910— 98,399 tons
Total, Tons.....473,784	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.40	.336	9.92	.14	3.17	.75	1.01	.068	4.90

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
7.58	51.20	.311	9.17

MAYVILLE RANGE

IRON RIDGE MINE.

Location: Dodge County, Wisconsin, Sections 1, 12, 13, 16 and 36, Townships 11 and 12, Range 16.

Description: First opened up in 1903. The ore is soft, yellowish brown, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1903—	17,913 tons	1907—	3,966 tons
1904—	19,558 tons	1908—	
1905—	39,978 tons	1909—	15,955 tons
1906—	61,634 tons	1910—	14,487 tons

Total, Tons173,481

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
44.95	1.68	5.75	.17	4.35	7.48	2.51	.062	11.40

MAYVILLE MINE.

Location: Dodge County, Wisconsin, Section 12, Township 11, Range 16.

Description: First opened up in 1893. Open pit and steam shovel systems of mining are used. The greatest vertical depth is 50 feet. The ore is soft, red and brown, Non-Bessemer Hematite. It is locally known as "Flax Seed" ore. The ore is crushed.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to The Mayville Furnace Company.

Yearly Shipments:

Prior to 1893—	9,044	1902—	23,338 tons
1893—	7,925 tons	1903—	18,836 tons
1894—	10,511 tons	1904—	26,562 tons
1895—	16,472 tons	1905—	20,610 tons
1896—	13,144 tons	1906—	15,847 tons
1897—	10,546 tons	1907—	19,644 tons
1898—	18,151 tons	1908—	71,341 tons
1899—	19,731 tons	1909—	66,804 tons
1900—	20,986 tons	1910—	77,195 tons
1901—	22,400 tons		

Total, Tons489,087

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
46.27	1.09	5.73	.15	4.00	6.33	3.12		

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.90	41.69	.982	5.16

MESABI RANGE

ADAMS MINE.

Location: St. Louis County, Minnesota, Sections 31 and 36, Township 58, Ranges 17 and 18.

Description: First opened up in 1895. GILWOOD ore, soft, slate colored, silicious, Bessemer Hematite. Ore from this mine goes into Groups 1, 4, Special Group 4, and Group One, High Manganese.

An open pit and underground mine. Greatest vertical depth is 314 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there to the lower lake ports by boat.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1895—	59,141 tons	1903—	1,109,750 tons
1896—	234,562 tons	1904—	940,105 tons
1897—	170,738 tons	1905—	1,140,984 tons
1898—	390,860 tons	1906—	1,238,350 tons
1899—	720,474 tons	1907—	1,136,513 tons
1900—	777,346 tons	1908—	765,592 tons
1901—	829,118 tons	1909—	1,829,372 tons
1902—	1,242,923 tons	1910—	1,258,295 tons

Total, Tons13,844,123

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Gilwood:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.08	.032	16.03	.45					

Group No. 1 High Manganese:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.70	.043	5.23	3.19					

The Ore in its natural state is as follows:

Gilwood:

Moist	Iron	Phos.	Silica
12.48	46.45	.025	14.03

Group No. 1 High Manganese:

Moist	Iron	Phos.	Silica
11.88	50.01	.038	4.61

See Analysis of Groups Nos. 1 and 4.

ADRIATIC MINE.

Location: St. Louis County, Minnesota, Section 30, Township 59, Range 14 West.

Description: First opened up in 1906. The ore is Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 145 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1906— 3,294 tons	1909—107,307 tons
1907— 70,187 tons	1910—135,685 tons
1908—108,129 tons	
Total Tons .....424,612	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.20	.078	10.55	.22	1.98	.36	.24	.007	6.10

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.50	49.74	.069	9.33

AGNEW MINE.

Location: St. Louis County, Minnesota, Section 11, Township 57 North, Range 21 West.

Description: First opened up in 1902. This ore is a soft, red, Bessemer Hematite. It is an open pit mine.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Owners: The Wisconsin Steel Co.

Yearly Shipments:

1902— 45,582 tons	1907—149,084 tons
1903—108,847 tons	1908—164,486 tons
1904— 96,435 tons	1909—151,536 tons
1905— 44,651 tons	1910—152,834 tons
1906—163,260 tons	

Total, Tons1,076,715

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.51	.051	8.68	.70	1.99				

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.73	49.89	.043	7.40

AJAX MINE (Formerly Kanawha Mine).

Location: St. Louis County, Minnesota, Section 1, Township 58, Range 16.

Description: First opened up in 1899. The ore is soft, yellow, Non-Bessemer Hematite. It is an open pit mine.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland, O.

Yearly Shipments:

1899— 14,963 tons	1903— 23,932 tons
1900— 64,218 tons	1904— 912 tons
1901— 41,300 tons	1905— 28,439 tons
1902— 24,829 tons	1906— 9,057 tons
Total, Tons .....207,650	

AUBURN MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 17.

Description: First opened up in 1894. Two ores are shipped from this mine, Bessemer and Non-Bessemer Hematite.

Operated by The Oliver Iron Mining Company. Now idle.

Yearly Shipments:

1894—108,210 tons	1899—385,992 tons
1895—376,970 tons	1900—263,692 tons
1896—131,478 tons	1901—427,510 tons
1897—175,263 tons	1902— 38,283 tons
1898—235,630 tons	

Total, Tons2,143,028

BANGOR MINE.

Location: St. Louis County, Minnesota, Sections 1 and 6, Township 58, Ranges 16 and 15.

Description: First opened up in 1910. The ore is Non-Bessemer Hematite. Underground mining system used. Greatest vertical depth 307 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1910— 17,673 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.50	.081	8.87	.96	2.81	.23	.20	.008	5.76

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.00	49.72	.071	7.80

BESSEMER MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1904. Two grades of ore are shipped from this mine, a soft, red, Bessemer and Non-

Bessemer Hematite. Slicing system of mining used. Greatest vertical depth, 210 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, Minnesota, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1904—86,303 tons	1908—120,350 tons
1905—112,630 tons	1909—227,767 tons
1906—131,791 tons	1910—117,173 tons
1907—78,012 tons	

Total, Tons874,026

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bessemer No. 3, 1st Grade:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.00	.050	9.95	1.03					

Bessemer No. 3, 2nd Grade:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.78	.058	11.20	1.45					

The Ore in its natural state is as follows:

Bessemer No. 3, 1st Grade:

Moist	Iron	Phos.	Silica
8.20	53.24	.046	9.13

Bessemer No. 3, 2nd Grade:

Moist	Iron	Phos.	Silica	Mang.
8.44	51.99	.053	10.25	1.33

BIWABIK MINE.

Location: St. Louis County, Minnesota, Sections 2 and 3, Township 58, Range 16.

Description: First opened up in 1893. This mine ships two ores, BIWABIK, a Bessemer Hematite and SHILLING, a Non-Bessemer Hematite.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The Tod-Stambaugh Company, Cleveland.

Mine shipment for 1910 was 544,353 tons.

BRAY MINE.

Location: Itasca County, Minnesota, Section 23, Township 57, Range 22.

Description: First opened up in 1909. This mine ships two grades of ore, both red, Non-Bessemer Hematites. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Al-
louez Bay, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Company, Cleveland.

Yearly Shipments:

1909— 65,514 tons	1910— 57,789 tons
Total, Tons .....123,303	

Analysis: The average of all cargo analysis for 1910 is as fol-
lows: Dried at 212° F.

Bray Ore:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.92	.070	6.52	1.22	1.93	.20	.18	.006	4.35

Bray No. 2 Ore:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.56	.070	6.88	1.42	1.88	.20	.18	.006	4.27

The Ore in its natural state is as follows:

Bray Ore:

Moist	Iron	Phos.	Silica
13.42	51.88	.061	5.65

Bray No. 2 Ore:

Moist	Iron	Phos.	Silica
12.33	52.22	.061	6.03

BRUNT MINE.

Location: St. Louis County, Minnesota, Section 10, Township
58, Range 18.

Description: First opened up in 1906. Two ores shipped from
this mine BRUNT, a Non-Bessemer, soft, red, Hematite and
MARION, a soft, red, Bessemer Hematite. Steam shovel
mining is used.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 75,401 tons	1909— 14,212 tons
1907—178,935 tons	1910—110,630 tons
1908— 636 tons	

Total, Tons379,814

Analysis: The average of all cargo analysis for 1910 is as fol-
lows: Dried at 212° F.

Brunt:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.42	.054	6.72	.49	5.75	.28	.80	.123	5.39

Marion:

56.43	.046	5.87	.50	5.51	.29	.37	.150	5.85
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The Ore in its natural state is as follows:

Brunt:

Moist	Iron	Phos.	Silica
15.22	47.83	.046	5.70

Marion:

Moist	Iron	Phos.	Silica
15.23	47.84	.039	4.98

BURT MINE.

Location: St. Louis County, Minnesota, Sections 31 and 36, Township 58, Ranges 20 and 21.

Description: First opened up in 1895. Ore from this mine goes into Groups 2, 3, 5 and 7. It is a soft Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe and Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905—1,860,452 tons	1908—1,460,998 tons
1906—1,376,875 tons	1909—1,660,101 tons
1907—1,501,272 tons	1910—1,032,815 tons
Total, Tons 8,892,513	

See Analysis of Groups Nos. 2, 3, 5 and 7.

CANISTEO MINE.

Location: Itasca County, Minnesota, Sections 29, 30 and 31, Township 56, Range 24.

Description: First opened up in 1907. This mine ships ALCON ore, a soft and hard, dark, brown Hematite; a soft, brown, Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, brown, Bessemer Hematite which goes into Groups 2 and 5.

Open pit system of mining is used. Greatest vertical depth 210 feet.

The ore is shipped to Duluth via the Duluth, Missabe and Northern Railway, and from there to the lower lake ports by boat.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1907— 5,454 tons	1909— 85,505 tons
1908— 2,760 tons	1910—1,105,160 tons
Total, Tons 1,198,879	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alcon:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.81	.047	11.90	.34					

The Ore in its natural state is as follows:

Alcon:

Moist	Iron	Phos.	Silica
10.45	50.87	.042	10.66

See Analysis of Groups Nos. 2, 3, 5 and 7.

CANTON MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 16.

Description: First opened up in 1893. The ore is a Bessemer Hematite.

Operated by the Oliver Iron Mining Company.

Yearly Shipments:

1893— 24,416 tons	1897—
1894—213,853 tons	1898—
1895—359,020 tons	1899— 99,498 tons
1896— 16,261 tons	
Total, Tons .....713,048	

CHISHOLM MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1901. Ore is a soft, brown and dark red, Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, dark yellow Bessemer Hematite, which goes into Group 2. Underground system of mining is used. Greatest vertical depth 255 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1901— 34,573 tons	1906—379,156 tons
1902—200,629 tons	1907—258,793 tons
1903—168,831 tons	1908—228,386 tons
1904—130,732 tons	1909—314,597 tons
1905—231,296 tons	1910—634,236 tons
Total, Tons .....2,581,229	

See Analysis of Groups Nos. 2, 3 and 7.

CLARK MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1900. This ore is a soft, Bessemer and Non-Bessemer Hematite, goes into Groups 2 and 3. Underground system of mining is used. Greatest vertical depth 201 feet.

The ore is shipped via the Duluth, Missabe and Northern Railway and the Great Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1900—63,071 tons	1906—274,394 tons
1901—199,566 tons	1907—319,983 tons
1902—350,799 tons	1908—334,594 tons
1903—300,492 tons	1909—484,512 tons
1904—256,873 tons	1910—529,222 tons
1905—358,091 tons	

Total, Tons3,471,597

See Analysis of Groups Nos. 2 and 3.

COLUMBIA MINE.

Location: St. Louis County, Minnesota, Section 6, Township 58, Range 17.

Description: First opened up in 1901. The ore is a soft, Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 160 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: W. G. Pollock, Cleveland.

Yearly Shipments:

1901—15,627 tons	1905—1,360 tons
Total, Tons .....16,987	

COMMODORE MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1893. Two ores are shipped from this mine, ADMIRAL, a soft, blue, Bessemer Hematite and COMMODORE, a soft, blue, Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Company, Cleveland.

Yearly Shipments:

1893—65,137 tons	1902—65,833 tons
1894—7,213 tons	1903—20,436 tons
1895—	1904—249 tons
1896—22,063 tons	1905—146,901 tons
1897—60,798 tons	1906—263,401 tons
1898—80,494 tons	1907—477,203 tons
1899—152,947 tons	1908—116,069 tons
1900—278,416 tons	1909—409,148 tons
1901—35,546 tons	1910—341,548 tons

Total, Tons2,543,402

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Commodore:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.80	.056	6.50	.72	1.82	.61	.58	.006	3.81

Admiral:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.22	.044	6.25	.88	1.16	.60	.27	.008	2.90

The Ore in its natural state is as follows:

Commodore:

Moist	Iron	Phos.	Silica
10.47	52.64	.050	5.82

Admiral:

Moist	Iron	Phos.	Silica
9.70	55.28	.040	5.64

CORSICA MINE.

Location: St. Louis County, Minnesota, Section 18, Township 58, Range 16 West.

Description: First opened up in 1901. The ore is Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 163 feet.

Ore shipped via the Duluth and Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company.

Yearly Shipments:

1901—26,838 tons	1906—100,606 tons
1902—59,292 tons	1907—172,226 tons
1903—34,043 tons	1908—77,674 tons
1904—30,131 tons	1909—135,366 tons
1905—	1910—277,537 tons

Total, Tons913,713

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.30	.048	9.24	.46	1.81	.27	.25	.009	5.75

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.00	51.00	.043	8.22

CROSBY MINE.

Location: Itasca County, Minnesota, Sections 31 and 32, Township 57, Range 22.

Description: First opened up in 1903. The ore is a soft, Bessemer Hematite. Open pit, milling and underground systems of mining are used. The greatest vertical depth is 80 feet. The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: The Cleveland-Cliffs Iron Company, Cleveland.

Yearly Shipments:

1906—115,373 tons	1909—183,470 tons
1907—227,265 tons	1910—159,569 tons
1908—152,084 tons	

Total, Tons837,761

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.00	.035	14.85	.49	1.31	.31	.23	.015	1.95

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.00	50.96	.032	13.51

CROXTON MINE.

Location: St. Louis County, Minnesota, Section 13, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red Non-Bessemer Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1902—18,594 tons	1907—349,853 tons
1903—100,297 tons	1908—154,868 tons
1904—348 tons	1909—159,038 tons
1905—130,228 tons	1910—71,632 tons
1906—162,533 tons	

Total, Tons1,147,391

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.40	.067	8.81	.33	1.92	.24	.23	.014	6.18

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.09	51.03	.060	7.83

CYPRUS MINE.

Location: St. Louis County, Minnesota, Section 3, Township 57, Range 21 W.

Description: First opened up in 1903. Two ores are shipped from this mine, CYPRUS, a Non-Bessemer Hematite; and ATHENS, a Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 134 feet.

This ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1903—121,818 tons	1907—260,948 tons
1904—244,343 tons	1908—115,745 tons
1905—235,351 tons	1909—107,685 tons
1906—192,144 tons	1910—102,233 tons

Total, Tons1,380,267

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Cyprus:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.25	.065	6.13	.36	1.61	.27	.29	.010	5.00

Athens:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.80	.040	7.04	.28	1.08	.20	.21	.010	4.18

The Ore in its natural state is as follows:

Cyprus:

Moist	Iron	Phos.	Silica
12.00	53.02	.057	5.39

Athens:

Moist	Iron	Phos.	Silica
9.80	54.84	.036	6.35

DAY MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1898. Bessemer and Non-Bessemer Hematite ores were shipped.

The mine was operated by The Oliver Iron Mining Company. Now idle.

Yearly Shipments:

1898—18,651 tons	1902—106,516 tons
1899—1,975 tons	1903—107,781 tons
1900—	1904—84,530 tons
1901—	

Total, Tons319,453

DULUTH MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 16.

Description: First opened up in 1893. The ore is a soft, brown, Bessemer Hematite. This ore goes into Groups 1 and 2. Milling system of mining is used. Greatest vertical depth 114 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1893— 37,626 tons	1902—150,220 tons
1894—	1903—150,053 tons
1895—	1904—149,819 tons
1896—	1905—142,172 tons
1897—	1906—158,336 tons
1898—112,155 tons	1907— 93,120 tons
1899—165,435 tons	1908—149,185 tons
1900—128,587 tons	1909—150,501 tons
1901—150,024 tons	1910— 57,239 tons

Total, Tons1,794,472

See Analysis of Groups Nos. 1 and 2.

ELBA MINE.

Location: St. Louis County, Minnesota, Section 13, Township 58, Range 17 West.

Description: First opened up in 1898. The ore is a Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 246 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1898— 564 tons	1905—125,724 tons
1899— 9,547 tons	1906—255,580 tons
1900—121,707 tons	1907—134,488 tons
1901—224,630 tons	1908—147,916 tons
1902—207,454 tons	1909—224,202 tons
1903— 93,616 tons	1910—186,993 tons
1904—123,425 tons	

Total, Tons1,855,846

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.10	.042	7.91	.78	1.12	.24	.22	.008	4.90

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.20	53.66	.038	7.18

EUCLID MINE.

Location: St. Louis County, Minnesota, Section 21, Township 58, Range 20.

Description: First opened up in 1909. Two ores are shipped from this mine, EUCLID, a soft, dark, brown, Non-Bessemer Hematite, and MADEIRA, a soft, dark, brown Bessemer Hematite.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 82,637 tons	1910— 53,009 tons
Total, Tons .....135,646	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Euclid:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.60	.093	7.54	.80	1.58	.27	.26	.012	5.28

Madeira:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.50	.044	5.67	.82	1.50	.18	.20	.012	3.40

The Ore in its natural state is as follows:

Euclid:

Moist	Iron	Phos.	Silica
12.50	51.28	.081	6.60

Madeira:

Moist	Iron	Phos.	Silica
10.50	55.04	.039	5.08

FAYAL MINE.

Location: St. Louis County, Minnesota, Sections 5 and 6, Township 57, Range 17.

Description: First opened up in 1895. The ore is soft, brown and yellow Bessemer and Non-Bessemer Hematite. This ore goes into groups 1, 2 and 4. Underground and open pit systems of mining are used. Greatest vertical depth 266 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1895— 136,601 tons	1903—1,460,601 tons
1896— 248,645 tons	1904— 975,102 tons
1897— 642,939 tons	1905—1,358,922 tons
1898— 575,933 tons	1906—1,634,853 tons
1899—1,072,257 tons	1907—1,878,812 tons
1900—1,252,504 tons	1908—1,439,879 tons
1901—1,656,973 tons	1909—1,879,357 tons
1902—1,919,172 tons	1910—1,485,099 tons
Total, Tons .....19,617,649	

See Analysis of Groups Nos. 1, 2 and 4.

FOREST MINE.

Location: Itasca County, Minnesota, S. E. $\frac{1}{4}$ of N. W. $\frac{1}{4}$, Section 13, Township 57, Range 22.

Description: First opened up in 1904. The ore is a soft, red Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 65 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1910—8,264 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.00	.040	10.00	.90	1.40	.25	.19	.020	3.50

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.00	51.62	.036	8.90

FWLER MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 15.

Description: First opened up in 1907. The ore is a soft, yellow, Non-Bessemer Hematite. Caving and slicing systems of mining are used. Greatest vertical depth 132 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1907— 34,014 tons	1909— 99,892 tons
1908— 21,511 tons	1910—204,640 tons
Total, Tons .....360,057	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.90	.064	12.47						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.14	47.14	.055	10.71

FRANKLIN MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1893. The ore is soft, red, blue and yellow Bessemer Hematite. Slicing system of mining is used. Greatest depth 200 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Company, Cleveland.

Yearly Shipments:

1893— 46,617 tons	1902—111,085 tons
1894—223,399 tons	1903— 92,019 tons
1895—286,423 tons	1904— 65,528 tons
1896—231,086 tons	1905—
1897— 30,128 tons	1906— 66,935 tons
1898—200,400 tons	1907— 30,926 tons
1899— 60,000 tons	1908— 8,246 tons
1900—168,524 tons	1909— 51,393 tons
1901— 39,299 tons	1910— 31,614 tons
Total, Tons .....1,743,622	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.35	.033	8.98	.83					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
6.45	55.52	.031	8.40

FRANTZ MINE.

Location: St. Louis County, Minnesota, Section 21, Township 58, Range 19.

Description: First opened up in 1904. The ore is soft, red Non-Bessemer Hematite. Slicing system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1904— 62,884 tons	1906— 11,068 tons
1905— 70,210 tons	1907— 907 tons
Total, Tons .....145,069	

GENOA MINE.

Location: St. Louis County, Minnesota, Section 34, Township 58, Range 17.

Description: First opened up in 1896. The ore is a soft, yellow, Non-Bessemer Hematite ore, goes into Group 4. Open pit and underground systems of mining are used. Greatest vertical depth 319 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1896—17,136 tons	1904—244,150 tons
1897—309,514 tons	1905—281,081 tons
1898—279,677 tons	1906—179,468 tons
1899—276,559 tons	1907—108,610 tons
1900—253,651 tons	1908—
1901—332,022 tons	1909—
1902—399,719 tons	1910—283,299 tons
1903—303,700 tons	

Total, Tons3,268,586

See Analysis of Group No. 4.

GILBERT MINE.

Location: St. Louis County, Minnesota, Section 26, Township 58, Range 17.

Description: First opened up in 1907. Soft, brown Bessemer ore goes into Group 1; soft, yellow Non-Bessemer ore goes into Group 4; a soft, grey, silicious Bessemer ore, called GILLWOOD. Underground and open pit systems of mining are used. Greatest vertical depth 224 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—100,178 tons	1909—783,683 tons
1908—336,927 tons	1910—110,788 tons

Total, Tons1,331,576

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Gillwood:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.08	.032	16.03	.45					

The Ore in its natural state is as follows:

Gillwood:

Moist	Iron	Phos.	Silica
12.48	46.45	.028	14.03

See Analysis of Groups Nos. 1 and 4.

GLEN MINE.

Location: St. Louis County, Minnesota, Section 29, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red and brown Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, yellow Bessemer Hematite which goes into Group 2. Underground system of mining is used. Greatest vertical depth is 265 feet.

The ore is shipped via the Duluth, Missabe and Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1902— 23,875 tons	1907—205,426 tons
1903—171,705 tons	1908—272,142 tons
1904—280,412 tons	1909—396,591 tons
1905—287,835 tons	1910—286,051 tons
1906—279,424 tons	

Total, Tons2,203,461

See Analysis of Groups Nos. 2, 3 and 7.

GRANT MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 19.

Description: First opened up in 1902. The ore is soft, bluish, Non-Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 126 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 51,946 tons	1907—
1903— 18,928 tons	1908—
1904— 44,413 tons	1909—
1905— 49,227 tons	1910—297,761 tons
1906—	

Total, Tons362,275

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.06	.112	7.35						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.31	50.91	.098	6.44

GROUP No. 1.

This Group is made up of ore from the following mines: Adams, Duluth, Fayal, Gilbert and Spruce.

The ore is a soft, red, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.22	.042	5.66	.55					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.12	52.92	.037	4.98

GROUP NO. 2.

This Group is made up of ore from the following mines:
Burt, Canisteo, Chisholm, Clark, Duluth, Fayal, Glen, Higgins, Hill, Holman, Hull-Rust, Morris, Myers, Sellers, Virginia and Winifred.

The ore is a soft, brown, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.97	.051	5.63	.62					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.74	54.42	.045	5.02

GROUP NO. 3.

This Group is made up of ore from the following mines:
Burt, Canisteo, Chisholm, Clark, Glen, Hartley, Holman, Hull-Rust, Leonard, Morris, Virginia, Winifred.

The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.06	.091	6.79	1.15					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.20	49.52	.079	5.89

GROUP NO. 4.

This Group is made up of ore from the following mines:
Adams, Fayal, Genoa, Gilbert, and Spruce.

The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.07	.072	7.19	.91					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
15.76	47.23	.060	6.05

GROUP NO. 5.

This Group is made up of ore from the following mines:
Burt, Canisteo, Higgins, Holman, Hull-Rust, Morris, Sellers, and Winifred.

The ore is a soft, brown, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.70	.043	12.99	.44					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.11	50.40	.038	11.55

GROUP NO. 7.

This Group is made up of ore from the following mines: Burt, Canisteo, Chisholm, Glen, Hartley, Hill, Holman, Hull-Rust, Leonard, Morris, Virginia, and Winifred.

The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.45	.094	12.31	.84					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.15	46.42	.081	10.69

HANNA MINE.

Location: St. Louis County, Minnesota, Sections 2 and 3, Township 58, Range 18.

Description: First opened up in 1909. Two ores are shipped from this mine, HANNA No. 1, a soft, red, Non-Bessemer Hematite; and HANNA No. 2, a soft, red Non-Bessemer Manganiferous Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1909—238,873 tons	1910—308,009 tons
Total, Tons .....546,882	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Hanna No. 1:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.60	.084	5.95	1.17	3.65	.83	.25	.016	5.55

Hanna No. 2:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.12	.077	6.02	2.20	3.07	.49	.33	.006	5.47

The Ore in its natural state is as follows:

Hanna No. 1:

Moist	Iron	Phos.	Silica
13.40	49.88	.073	5.15

Hanna No. 2:

Moist	Iron	Phos.	Silica
13.21	49.57	.067	5.22

HARTLEY MINE.

Location: St. Louis County, Minnesota, Sections 23 and 24, Township 58, Range 20.

Description: First opened up in 1907. The ore is soft, dark red Non-Bessemer Hematite, which goes into Groups 3 and 7. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—334,646 tons	1909—
1908—55,462 tons	1910—113,512 tons
Total, Tons .....503,620	

See Analysis of Groups 3 and 7.

HAWKINS MINE.

Location: Itasca County, Minnesota, Sections 31 and 32, Township 57 North, Range 22 West.

Description: First opened up in 1902. Two ores are shipped from this mine, NANOBE, a soft, red Non-Bessemer Hematite; and HAWKINS, a soft, red Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Owners: Wisconsin Steel Co.

Yearly Shipments:

1902—5,892 tons	1907—270,984 tons
1903—107,905 tons	1908—248,246 tons
1904—99,055 tons	1909—316,783 tons
1905—202,070 tons	1910—224,406 tons
1906—294,588 tons	

Total, Tons1,769,929

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Hawkins

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.44	.045	11.60	.16	1.78				

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.65	50.75	.040	10.25

HECTOR MINE (formerly Hale Mine).

Location: St. Louis County, Minnesota, Section 1, Township 58, Range 16.

Description: First opened up in 1893. The ore is soft, yellow Non-Bessemer Hematite. Milling and underground mining systems used. Greatest vertical depth is 162 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1893— 3,616 tons	1902— 54,289 tons
1894— 24,167 tons	1903—
1895— 31,004 tons	1904—
1896— 70,006 tons	1905— 4,990 tons
1897— 13,728 tons	1906— 37,221 tons
1898—	1907— 65,952 tons
1899— 18,807 tons	1908—
1900— 32,901 tons	1909— 30,726 tons
1901— 30,929 tons	1910— 82,393 tons

Total, Tons500,729

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.00	.069	12.59						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.53	46.15	.059	10.76

HELMER MINE.

Location: St. Louis County, Minnesota, Section 14, Township 58, Range 19.

Description: This mine is not yet opened up. Open pit system of mining will be used. The ore is Non-Bessemer Hematite.

HIGGINS MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 17.

Description: First opened up in 1904. The ore is soft, dark gray, Bessemer Hematite. This ore goes into Groups 2 and 5 and Chemung Groups 2 and 5. Underground, milling and open pit systems of mining are used. Greatest vertical depth 166 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1904— 35,286 tons	1908—
1905—238,598 tons	1909—322,504 tons
1906—341,319 tons	1910—151,854 tons
1907—173,439 tons	

Total, Tons1,263,000

See Analysis of Groups Nos. 2 and 5.

HILL MINE.

Location: Itasca County, Minnesota, Section 17, Township 56, Range 23.

Description: First opened up in 1910. The ore is soft, brown Bessemer Hematite which goes into Group 2, and soft, brown Non-Bessemer Hematite which goes into Group 7. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1910—801,088 tons

See Analysis of Groups Nos. 2 and 7.

HOBART MINE.

Location: St. Louis County, Minnesota, Section 25, Township 58, Range 17.

Description: First opened up in 1906. The ore is a soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 248 feet.

This ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 975 tons 1907— 7,339 tons

Total, Tons8,314

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.00	.082	8.10	1.06	1.50	.22	.14	.010	

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.00	53.10	.074	7.29

HOLMAN MINE.

Location: Itasca County, Minnesota, Section 21, Township 56, Range 24.

Description: First opened up in 1907. This ore is a hard and soft, dark brown Bessemer Hematite called ALCON; a soft, dark brown Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, dark brown Bessemer Hematite which goes into Groups 2 and 5. Open pit system of mining is used. Greatest vertical depth 201 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—	8,068 tons	1909—	391,157 tons
1908—	1,682 tons	1910—	413,873 tons
Total, Tons		814,780	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alcon:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.81	.047	11.90	.34					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.45	50.87	.042	10.66

See Analysis of Groups Nos. 2, 3, 5 and 7.

JENNINGS MINE.

Location: St. Louis County, Minnesota, Section 14, Township 58, Range 19.

Description. First opened up in 1906. The ore is a soft, red, Non-Bessemer Hematite. Open pit system of mining is used. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906—	84,715 tons	1908—	18,313 tons
1907—	99,812 tons	1909—	10,477 tons
Total, Tons		213,317	

HUDSON MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description; First opened up in 1910. The ore is Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1910—168,553 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.20	.065	6.67	.92	1.77	.21	.18	.012	5.32

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.50	51.80	.057	5.84

HULL-RUST MINE.

Location: St. Louis County, Minnesota, Sections 1 and 2, Township 57, Range 21.

Description: First opened up in 1896. The ore is a soft, reddish brown Non-Bessemer which goes into Groups 3 and 7, and a soft, black and yellowish red Bessemer which goes into Groups 2 and 5. Open pit system of mining. The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1906—1,690,311 tons	1909—3,039,911 tons
1907—2,900,493 tons	1910—3,189,975 tons
1908—2,926,683 tons	

Total, Tons13,747,373

See Analysis of Groups Nos. 2, 3, 5 and 7.

JORDAN MINE.

Location: St. Louis County, Minnesota, Section 22, Township 58, Range 20.

Description: First opened up in 1902. Soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 193 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1902—147,931 tons	1907— 61,996 tons
1903—190,024 tons	1908—118,529 tons
1904— 97,474 tons	1909— 12,754 tons
1905—185,854 tons	1910— 20,314 tons
1906—110,768 tons	

Total, Tons945,644

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.36	.063	7.48	.54	1.18	.19	.14	.015	3.86

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.10	54.26	.057	6.72

KELLOGG MINE.

Location: St. Louis County, Minnesota, N. W. $\frac{1}{4}$ of N. E. $\frac{1}{4}$, Section 9, Township 58, Range 16.

Description: First opened up in 1908. Two ores are shipped from this mine, KELLOGG, a soft, brown Bessemer Hema-

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Yearly Shipments:

1909—165,458 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.10	.039	13.54	.60	1.86	.26	.25	.031	3.17

Moist	Iron	Phos.	Silica
9.63	50.70	.035	12.24

Location: St. Louis County, Minnesota, Section 14, Township 58,
Range 19.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Yearly Shipments:

1906—	57,697 tons	1910—	401,920 tons
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Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.80	.080	3.96	.75	1.84	.25	.22	.032	5.07

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.70	.084	4.16	1.25	1.85	.10	.15	.041	6.19

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.71	.081	4.92	2.28	2.65	.30	.45	.018	7.45

The Ore in its natural state is as follows:

Kinney No. 1.			
Moist	Iron	Phos.	Silica
13.47	52.61	.069	3.43
Kinney No. 2:			
Moist	Iron	Phos.	Silica
13.13	51.86	.073	3.61
Kinney No. 3:			
Moist	Iron	Phos.	Silica
13.31	49.16	.070	4.27

KNOX MINE.

Location: St. Louis County, Minnesota, S. E. $\frac{1}{4}$ of S. W. $\frac{1}{4}$, Section 19, Township 59, Range 14.

Description: First opened up in 1909. The ore is a soft, red Non-Bessemer Hematite. Caving system of mining used. Greatest vertical depth 117 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Owners: The New York State Steel Company.

Yearly Shipments:

1909—	7,464 tons	1910—	50,942 tons
		Total, Tons	.....58,406

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.79	.074	11.03	.25					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.50	51.14	.065	9.76

LABELLE MINE.

Location: St. Louis County, Minnesota, Section 24, Township 58, Range 17 West.

Description: First opened up in 1901. The ore is a soft, brown Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 220 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The LaBelle Iron Works, Steubenville, Ohio.

Yearly Shipments:

1902—	70,753 tons	1907—	56,146 tons
1903—	48,298 tons	1908—	51,638 tons
1904—	89,554 tons	1909—	27,216 tons
1905—	78,597 tons	1910—	20,349 tons
1906—	50,466 tons		

Total, Tons493,017

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.94	.037	9.79	.82	1.01	.44	.28	.019	3.32

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.26	48.57	.032	8.41

LARKIN MINE (formerly Tesora Mine).

Location: St. Louis County, Minnesota, N. E. $\frac{1}{4}$ of N. E. $\frac{1}{4}$, Section 4, Township 58, Range 17.

Description: First opened up in 1906. The ore is a soft, brown Bessemer Hematite. Caving system of mining is used. Greatest vertical depth about 90 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906—12,001 tons	1909—46,651 tons
1907—22,040 tons	1910—21,700 tons
1908—14,030 tons	

Total, Tons116,422

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
49.30	.032	20.90	1.69					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.00	44.86	.029	19.19

LA RUE MINE.

Location: Itasca County, Minnesota, Section 29 and 32, Township 57, Range 22 West.

Description: First opened up in 1903. Two ores are shipped from this mine. LA RUE, a soft, red Bessemer Hematite; and NASHWAUK, a soft, red Non-Bessemer Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1903—53,335 tons	1907—301,522 tons
1904—105,170 tons	1908—79,313 tons
1905—197,192 tons	1909—365,543 tons
1906—175,670 tons	1910—128,658 tons

Total, Tons1,406,403

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

La Rue:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.00	.040	12.26	.97	1.52	.21	.18	.032	2.35

Nashauk:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.30	.053	13.66	.35	4.15	.15	.12	.011	7.77

The Ore in its natural state is as follows:

La Rue:

Moist	Iron	Phos.	Silica
8.00	52.44	.037	11.28

Nashauk:

Moist	Iron	Phos.	Silica
9.27	50.17	.048	12.39

LAURA MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 220 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

The mine is owned by the Inland Steel Company.

Yearly Shipments:

1902— 16,453 tons	1907—149,410 tons
1903— 79,286 tons	1908—176,725 tons
1904— 3,778 tons	1909—178,110 tons
1905— 27,207 tons	1910—189,046 tons
1906—138,601 tons	

Total, Tons958,016

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.30	.080	8.90	1.05	1.75				

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica	Mang.
13.75	47.70	.069	7.68	

LEETONIA MINE.

Location: St. Louis County, Minnesota, Section 10, Township 57, Range 21.

Description: First opened up in 1902. The ore is a soft, yellow Non-Bessemer Hematite. Underground and open pit systems of mining are used. Greatest vertical depth 100 feet.

The ore is shipped via the Great Northern Railway to Superior and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902—28,784 tons	1907—301,368 tons
1903—200,163 tons	1908—289,490 tons
1904—228,536 tons	1909—553,162 tons
1905—352,004 tons	1910—615,396 tons
1906—308,989 tons	

Total, Tons2,877,892

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.08	.056	5.16						
Moist	Iron	Phos.	Silica					
12.97	51.42	.049	4.49					

LEONARD MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1903. The ore is a soft Non-Bessemer Hematite which goes into Groups 3 and 7. Underground and open pit systems of mining are used. Greatest vertical depth is 253 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1903—10,591 tons	1907—137,316 tons
1904—151,952 tons	1908—
1905—297,011 tons	1909—6,857 tons
1906—254,368 tons	1910—987,910 tons
Total, Tons .....1,846,005	

See Analysis of Groups Nos. 3 and 7.

LILEY MINE.

Location: St. Louis County, Minnesota, Section 16, Township 58, Range 17.

Description: First opened up in 1907. Ore from this mine is called ALBERTA. It is a soft, blue black Bessemer and Non-Bessemer Hematite. Caving system of mining is used. Greatest vertical depth 110 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907—31,032 tons	1909—
1908—51,143 tons	1910—25,404 tons
Total, Tons .....107,579	

LINCOLN MINE.

Location: St. Louis County, Minnesota, Sections 4 and 5, Township 58, Range 17.

Description: First opened up in 1902. This mine ships DOUGLAS ore, a soft, brown Bessemer Hematite. Slicing system of mining is used. Greatest vertical depth is 237 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 87,908 tons	1907—297,870 tons
1903—279,399 tons	1908—379,219 tons
1904—153,822 tons	1909—303,066 tons
1905—275,777 tons	1910—318,912 tons
1906—367,192 tons	

Total, Tons2,463,165

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.09	.031	12.55						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
7.86	53.52	.029	11.56

LONGYEAR MINE.

Location: St. Louis County, Minnesota, Section 5 and 6, Township 57, Range 20.

Description: First opened up in 1902. The ore is a soft Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 100 feet.

The ore is shipped via the Great Northern Railway to Superior and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 22,788 tons	1904— 221 tons
1903— 81,604 tons	1905— 16,778 tons
Total, Tons .....121,391	

MADERIA MINE.

Location: St. Louis County, Minnesota, Section 36, Township 58, Range 21.

Description: First opened up in 1910. The ore is a soft, dark brown Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 100 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1910— 83,922 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.50	.044	5.67	.82	1.50	.18	.20	.012	3.40

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.50	55.04	.039	5.08

MAHONING MINE.

Location: St. Louis County, Minnesota, Sections 1 and 2, Township 57 North, Range 21 West.

Description: First opened up in 1895. Three ores are shipped from this mine, MAHONING, a Bessemer Hematite; and BEAVER and STOCK, both Non-Bessemer Hematites. Open pit system of mining is used. Greatest vertical depth is 125 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1895—	117,884 tons	1903—	1,009,446 tons
1896—	167,245 tons	1904—	706,325 tons
1897—	519,892 tons	1905—	1,011,661 tons
1898—	520,751 tons	1906—	1,274,232 tons
1899—	750,341 tons	1907—	1,564,336 tons
1900—	911,021 tons	1908—	611,592 tons
1901—	765,872 tons	1909—	1,561,893 tons
1902—	1,038,645 tons	1910—	1,515,723 tons

Total, Tons14,046,855

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mahoning:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
64.00	.047	2.70	.76	1.66	.20	.12	.005	3.07

Beaver:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
63.02	.081	3.01	.42	1.31	.11	.17	.031	4.61

Stock:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.20	.100	6.30	.55	1.97	.04	.10	.011	7.14

The Ore in its natural state is as follows:

Mahoning:

Moist	Iron	Phos.	Silica
11.21	56.83	.042	2.40

Beaver:

Moist	Iron	Phos.	Silica
10.71	56.27	.072	2.69

Stock:

Moist	Iron	Phos.	Silica
15.79	48.17	.084	5.31

MALTA MINE.

Location: St. Louis County, Minnesota, Section 35, Township 58, Range 17 West.

Description: First opened up in 1899. The ore is a Bessemer Hematite. Underground system of mining is used. Greatest vertical depth is 234 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1899—	28,615 tons	1905—	139,853 tons
1900—	65,346 tons	1906—	115,763 tons
1901—	126,299 tons	1907—	82,062 tons
1902—	222,640 tons	1908—	93,072 tons
1903—	11,695 tons	1909—	92,356 tons
1904—	66,641 tons	1910—	72,035 tons

Total, Tons1,116,360

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.20	.022	19.10	.32	.58	.17	.21	.008	2.00

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
8.00	49.86	.020	17.57

MARISKA MINE.

Location: St. Louis County, Minnesota, Section 24, Township 58, Range 17.

Description: First opened up in 1907. The ore is a soft, red, Non-Bessemer Hematite. Slicing system of mining is used. Greatest vertical depth 208 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the Lower Lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907—	137 tons	1909—	77,690 tons
1908—	30,226 tons	1910—	23,265 tons

Total, Tons131,318

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.34	.054	12.99	.30					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.35	50.26	.047	11.39

McKINLEY MINE.

Location: St. Louis County, Minnesota, Section 8, Township 58, Range 16.

Description: First opened up in 1907. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—	17,705 tons	1909—	89,981 tons
1908—	1,399 tons	1910—	
Total, Tons .....109,086			

MEADOW MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 15.

Description: First opened up in 1910. The ore is a soft, red Non-Bessemer Hematite. The caving and slicing system of mining is used. The greatest vertical depth is 250 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1910—	4,392 tons
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Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.41	.073	11.94						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.24	47.20	.063	10.36

MILLER MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description: First opened up in 1904. The ore is a soft, brown Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: The LaBelle Iron Works, Steubenville, Ohio.

Yearly Shipments:

1905—118,520 tons	1908—224,321 tons
1906—234,071 tons	1909—277,119 tons
1907—279,453 tons	1910—216,263 tons

Total, Tons1,349,747

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.01	.082	5.30	.78	2.48				6.53

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.80	53.23	.074	4.78

MINNEWAS MINE.

Location: St. Louis County, Minnesota, Section 16, Township 58, Range 17.

Description: First opened up in 1893. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1893—13,858 tons	1898—525 tons
1894—2,140 tons	1910—963 tons

Total, Tons17,486

MINORCA MINE.

Location: St. Louis County, Minnesota, Sections 4 and 5, Township 58, Range 17 West.

Description: First opened up in 1902. The ore is a Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 86 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1902—35,499 tons	1907—154,661 tons
1903—115,886 tons	1908—80,330 tons
1904—121,739 tons	1909—119,154 tons
1905—117,653 tons	1910—66,511 tons
1906—155,541 tons	

Total, Tons966,974

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.90	.036	11.97	1.20	1.08	.30	.26	.007	3.36

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
6.50	53.20	.034	11.19

MOHAWK MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description: First opened up in 1906. The ore is Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 186 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1906— 92,715 tons	1909—216,291 tons
1907—128,870 tons	1910—123,180 tons
1908—119,439 tons	

Total, Tons680,495

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.40	.084	7.83	.76	2.36	.24	.28	.008	6.02

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.50	50.23	.074	6.85

MONICA MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 16.

Description: First opened up in 1909. The ore is a soft, red Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 180 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

The mine is operated by the Republic Iron & Steel Company.

Yearly Shipments:

1909— 7,614 tons	1910— 69,503 tons
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Total, Tons77,117

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.87	.036	12.23	.34					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.00	51.18	.032	11.00

MONROE MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1905. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905— 13,730 tons	1908—
1906—310,839 tons	1909—147,521 tons
1907—156,809 tons	1910—

Total, Tons628,899

MORRIS MINE.

Location: St. Louis County, Minnesota, Section 31 and 32, Township 58, Range 20.

Description: First opened up in 1905. The soft, yellowish red Non-Bessemer ore goes into Groups 3 and 7, and the yellow Bessemer ore goes into Groups 2 and 5. Open pit system of mining is used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth and from there by boat to the lower lake ports.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905—1,070,937 tons	1908— 528,154 tons
1906—1,809,743 tons	1909—1,831,187 tons
1907—2,076,388 tons	1910—1,364,673 tons

Total, Tons8,681,082

See Analysis of Groups Nos. 2, 3, 5 and 7.

MOUNTAIN IRON (formerly Aetna) MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 18.

Description: First opened up in 1892. The ore is Bessemer and Non-Bessemer Hematite. The open pit system of mining is used.

This mine is operated by The Oliver Iron Mining Co.

Yearly Shipments:

1892— 4,245 tons	1902—1,617,772 tons
1893— 121,463 tons	1903—1,348,714 tons
1894— 573,440 tons	1904—1,168,855 tons
1895— 371,274 tons	1905—2,495,089 tons
1896— 159,744 tons	1906—2,563,111 tons
1897— 773,538 tons	1907—1,973,519 tons
1898— 650,955 tons	1908— 206,698 tons
1899—1,137,970 tons	1909—
1900—1,001,324 tons	1910—
1901—1,058,160 tons	

Total, Tons17,198,871

MYERS MINE.

Location: St. Louis County, Minnesota, Section 22, Township 58, Range 20.

Description: First opened up in 1905. The ore is a dark, brown, Bessemer Hematite and goes into Group 2. Underground system of mining is used. Greatest vertical depth is 206 feet. The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905—188,568 tons	1908—150,249 tons
1906—228,451 tons	1909—193,698 tons
1907—153,770 tons	1910—131,440 tons
Total, Tons .....1,046,176	

See Analysis of Group No. 2.

NASSAU MINE.

Location: St. Louis County, Minnesota, Section 5, Township 57, Range 20.

Description: First opened up in 1907. The ore is soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth is 180 feet.

The ore is shipped via the Duluth, Messabe & Northern and the Great Northern Railways to Duluth and Superior and from these docks by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1907— 19,172 tons	1909— 11,940 tons
1908—	1910— 39 tons
Total, Tons .....31,151	

ONONDAGA MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 17.

Description: First opened up in 1907. The ore is soft, grey, silicious Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 127 feet.

The ore is shipped via the Great Northern Railway to Alouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907— 521 tons	1909— 59,389 tons
1908— 30,887 tons	1910— 61,935 tons
Total, Tons .....152,732	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.93	.019	19.90	2.85					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
7.35	49.97	.018	18.44

PEARCE MINE.

Location: St. Louis County, Minnesota, N. E. $\frac{1}{4}$ of N. W. $\frac{1}{4}$,
Section 28, Township 58, Range 20.

Description: First opened up in 1902. The ore is soft, dark brown Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 110 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1902—	54,884 tons	1907—	71,645 tons
1903—	50,204 tons	1908—	
1904—	235 tons	1909—	
1905—		1910—	60,411 tons
1906—	65,682 tons		

Total, Tons303,241

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.67	.045	7.26	.82	1.74	.20	.22	.010	3.73

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.50	54.00	.041	6.57

PEARSON MINE.

Location: Itasca County, Minnesota, Section 29, Township 57, Range 22.

Description: First opened up in 1909. The ore is soft, brown Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 150 feet.

The ore is shipped by the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909—	68,683 tons	1910—	78,133 tons
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Total, Tons146,816

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.60	.036	15.42	1.02	1.62	.24	.23	.009	2.96

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.00	49.69	.033	14.03

PENOBSCOT MINE.

Location: St. Louis County, Minnesota, Section 1, Township 57, Range 21.

Description: First opened up in 1897. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1897— 11,933 tons	1901—221,080 tons
1898— 29,652 tons	1902—209,531 tons
1899— 85,619 tons	1903— 1,615 tons
1900—146,641 tons	

Total, Tons706,071

PERKINS MINE.

Location: St. Louis County, Minnesota, Section 26, Township 59, Range 15.

Description: First opened up in 1909. The ore is soft, brown Non-Bessemer Hematite. Open pit system of mining is used. The greatest vertical depth is 120 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 59,029 tons	1910— 80,622 tons
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Total, Tons139,651

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.50	.084	6.88	.36	2.01	.32	.26	.011	6.27

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.00	50.90	.073	5.99

PETTIT MINE.

Location: St. Louis County, Minnesota, Section 25, Township 58, Range 17.

Description: First opened up in 1902. The ore is soft, red Non-Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 244 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1902— 17,278 tons	1907— 36,074 tons
1903— 52,706 tons	1908— 57,140 tons
1904— 27,088 tons	1909— 83,548 tons
1905—140,239 tons	1910— 62,456 tons
1906— 82,757 tons	

Total, Tons559,286

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.12	.061	11.12	.43	2.32	.34	.20	.011	4.70

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.60	47.93	.052	9.50

PILLSBURY MINE.

Location: St. Louis County, Minnesota, Section 29, Township 58, Range 20.

Description: First opened up in 1898. The ore is Bessemer and Non-Bessemer Hematite. The open pit system of mining is used.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1898—99,691 tons	1904—
1899—106,487 tons	1905—161,924 tons
1900—101,032 tons	1906—33,546 tons
1901—120,723 tons	1907—489,718 tons
1902—238,122 tons	1908—59,889 tons
1903—229,133 tons	

Total, Tons1,640,265

ROBERTS MINE.

Location: St. Louis County, Minnesota, S. W. $\frac{1}{4}$ of N. W. $\frac{1}{4}$, Section 8, Township 58, Range 16.

Description: First opened up in 1897. The ore is soft, brown Bessemer Hematite. The caving system of mining is used. The greatest vertical depth is 65 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1897—18,614 tons	1904—
1898—	1905—
1899—57,847 tons	1906—
1900—41,965 tons	1907—
1901—42,756 tons	1908—
1902—28,972 tons	1909—
1903—	1910—26,915 tons

Total, Tons217,069

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.69	.033	16.37	.55					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.50	49.49	.030	14.81

SAUNTRY ALPENA MINE.

Location: St. Louis County, Minnesota, Section 5, Township 58, Range 17.

Description: First opened up in 1898. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1898— 53,004 tons	1901—249,837 tons
1899— 68,560 tons	1910—242,373 tons
1900—328,739 tons	

Total, Tons942,513

SCHLEY MINE.

Location: St. Louis County, Minnesota, Section 25, Township 58, Range 17.

Description: First opened up in 1910. The ore is soft, red, Bessemer and Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 160 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1910— 13,369 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.00	.080		.50					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.00	51.04	.070	

SCRANTON (Formerly Elizabeth) MINE.

Location: St. Louis County, Minnesota, Section 12, Township 57, Range 21.

Description: First opened up in 1904. The ore is Non-Bessemer Hematite. Underground system of mining is used.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1904— 1,168 tons	1910— 7,214 tons
1905-1909—	

Total, Tons8,382

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.50	.073	8.03	1.05	3.20	.17	.22	.010	6.27

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.50	50.00	.065	7.11

SELLERS MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57, Range 20.

Description: First opened up in 1895. The ore is a soft brownish and grayish black Bessemer Hematite, and goes into groups 2 and 5. Open pit system of mining is used. The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1895— 47,433 tons	1903—251,631 tons
1896— 153,037 tons	1904—207,990 tons
1897—	1905—261,501 tons
1898—112,765 tons	1906—241,031 tons
1899—174,867 tons	1907—155,060 tons
1900— 56,280 tons	1908—354,780 tons
1901— 34,918 tons	1909—626,169 tons
1902—193,428 tons	1910—954,042 tons

Total, Tons3,824,932

See Analysis of Groups Nos. 2 and 5.

SEVILLE MINE.

Location: St. Louis County, Minnesota, Section 10, Township 58, Range 19.

Description: First opened up in 1909. This mine ships MADEIRA ore, a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 180 feet.

The ore is shipped via the Great Northern Railway to Alouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 23,585 tons	1910— 2,677 tons
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Total, Tons26,262

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.50	.044	5.67	.82	1.50	.18	.20	.012	3.40

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.50	55.04	.039	5.07

SHARON MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 19.

Description: First opened up in 1901. The ore is Non-Bessemer Hematite.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1901—	56,810 tons	1903—	48,199 tons
1902—	224,526 tons	Total, Tons	.....329,535

SHENANGO MINE.

Location: St. Louis County, Minnesota, Sections 22, 23 and 27, Township 58, Range 20.

Description: First opened up in 1902. This mine ships two ores, SHENANGO, a black, semi-hard, Bessemer Hematite, and WILPEN, a black, semi-hard, Non-Bessemer Hematite. Underground and open pit systems of mining are used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is owned by the Shenango Furnace Company.

Yearly Shipments:

1904—	51,712 tons	1908—	461,887 tons
1905—	213,097 tons	1909—	831,099 tons
1906—	383,717 tons	1910—	965,148 tons
1907—	387,093 tons	Total, Tons	.....3,293,753

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.45	.048	5.35	1.08					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
12.26	53.04	.042	4.69

SLIVER MINE.

Location: St. Louis County, Minnesota, Sections 5 and 6, Township 58½, Range 17.

Description: First opened up in 1908. The mine ships two ores, DOVER, a soft, red, Non-Bessemer Hematite, and SLIVER MANGANESE, a soft, red, Non-Bessemer Manganiferous Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1908—	49,291 tons	1910—	358,432 tons
1909—	256,073 tons	Total, Tons,	.....663,796

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Dover:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.90	.079	5.81	.62	1.76	.20	.18	.011	4.92

Sliver Manganese:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.80	.072	6.25	.98	2.34	.27	.21	.012	4.07

The Ore in its natural state is as follows:

Dover:

Moist	Iron	Phos.	Silica
13.37	51.89	.068	5.03

Sliver Manganese:

Moist	Iron	Phos.	Silica
13.18	51.92	.063	5.43

SPRING MINE.

Location: St. Louis County, Minnesota, Section 11, Township 59, Range 14.

Description: First opened up in 1906. The ore is soft, grayish, blue, Bessemer Hematite. Underground and open pit systems of mining are used. The greatest vertical depth is 120 feet. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907—	15,257 tons	1909—	
1908—	20,516 tons	1910—	31,909 tons
		Total, Tons	67,682

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
52.22	.033	21.84						

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.19	47.42	.030	19.83

SPRUCE MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 17.

Description: First opened up in 1894. The ore is Bessemer and Non-Bessemer Hematite, and goes into Groups 1 and 4 and Special Group 4. Underground system of mining is used. The greatest vertical depth is 281 feet. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1894—	5,628 tons	1903—	587,153 tons
1895—	47,700 tons	1904—	589,319 tons
1896—	96,280 tons	1905—	606,295 tons
1897—	12,215 tons	1906—	674,602 tons
1898—		1907—	610,457 tons
1899—	1,621 tons	1908—	430,633 tons
1900—		1909—	579,903 tons
1901—	279,515 tons	1910—	613,947 tons
1902—	543,203 tons		

Total, Tons5,678,471.

See Analysis of Groups Nos. 1 and 4.

ST. CLAIR MINE.

Location: St. Louis County, Minnesota, Section 23, Township 58, Range 20.

Description: First opened up in 1900. The ore is Non-Bessemer Hematite.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1900—	101,675 tons	1903—	6,148 tons
1901—		1904—	26,748 tons
1902—		1905—	61,792 tons

Total, Tons196,363

ST. JAMES MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 15.

Description: First opened up in 1906. The ore is soft, blue, Non-Bessemer Hematite. The underground system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, Minn.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.65	.077	8.96	.63	2.98	.27	.16	.008	4.45

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.75	50.88	.068	7.91

ST. PAUL MINE.

Location: Itasca County, Minnesota, Section 24, Township 57, Range 22.

Description: First opened up in 1905. The ore is soft, blue, Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Alouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1906—	24,230 tons	1909—
1907—	113,200 tons,	1910—
1908—		

Total, Tons137,430

Analysis: Expected analysis for season of 1911 is as follows:

Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.79	.073	8.36	.51	2.94	.23	.29	.006	4.25

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
11.65	51.06	.064	7.39

STEPHENS MINE.

Location: St. Louis County, Minnesota, Sections 23, 25 and 26, Township 59, Range 15.

Description: First opened up in 1903. The ore is Non-Bessemer Hematite.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1903—	87,055 tons	1905—	367,764 tons
1904—			

Total, Tons454,81

STEVENSON MINE.

Location: St. Louis County, Minnesota, Sections 7 and 8, Township 57, Range 21.

Description: First opened up in 1900. This mine ships two ores, STEVENSON, a soft, blue, Bessemer Hematite, and WALLACE, a soft, blue, Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Alouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1900—	56,031 tons	1906—	1,041,500 tons
1901—	666,273 tons	1907—	1,142,977 tons
1902—	1,434,681 tons	1908—	516,770 tons
1903—	1,014,582 tons	1909—	1,030,742 tons
1904—	1,652,021 tons	1910—	953,079 tons
1905—	1,428,614 tons		

Total, Tons10,937,270

Stevenson:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.10	.043	5.88	.87	.91	.76	.12	.007	3.62

Wallace:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.57	.057	6.86	.93	.98	.40	.25	.009	3.48

The Ore in its natural state is as follows:

Stevenson:

Moist	Iron	Phos.	Silica
9.14	55.52	.039	5.34

Wallace:

Moist	Iron	Phos.	Silica
9.78	54.65	.051	6.19

SUSQUEHANNA MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57 North, Range 20 West.

Description: First opened up in 1906. The ore is soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 192 feet.

The ore is shipped via the Duluth, Messabe and Northern Railway to Duluth, and via the Great Northern Railway to Superior; from these points by boat to the lower lake ports.

Sales Agents: The Rogers Brown Iron Company, Buffalo, N. Y.

Yearly Shipments:

1906—	20,984 tons	1909—	243,049 tons
1907—	137,207 tons	1910—	176,869 tons
1908—	182,352 tons		

Total, Tons760,461

SWEENEY MINE.

Location: St. Louis County, Minnesota, Sections 3 and 4, Township 57, Range 21.

Description: First opened up in 1908.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1908—	7,579 tons	1910—	769 tons
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Total, Tons8,348

TROY MINE.

Location: St. Louis County, Minnesota, Section 7, Township 57, Range 17 West.

Description: First opened up in 1903. The ore is a Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 125 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the Lower Lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1903— 15,099 tons	1907—100,730 tons
1904— 12,759 tons	1908— 40,283 tons
1905— 87,584 tons	1909— 86,520 tons
1906—146,849 tons	1910—104,057 tons

Total, Tons593,881

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.40	.043	16.68	1.08	1.48	.48	.88	.246	5.15

The Ore in its natural state is as follows:

Moist Iron	Phos.	Silica
14.00	44.20	.037 14.34

UNION MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1900. The ore is soft, red, Bessemer and Non-Bessemer Hematite. Open pit system of mining is used. The greatest vertical depth is 204 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the Lower Lake Ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1900— 8,297 tons	1905—
1901— 93,109 tons	1906— 20,691 tons
1902—103,522 tons	1907— 61,825 tons
1903— 91,496 tons	1908— 20,937 tons
1904—	

Total, Tons399,877

UTICA MINE.

Location: St. Louis County, Minnesota, Sections 2 and 11, Township 57, Range 21 West.

Description: First opened up in 1902. There are two ores shipped from this mine, ALBANY, a Non-Bessemer Hematite; and CRETE, a Bessemer Hematite. The open pit and underground systems of mining are now being used. The greatest vertical depth is 150 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1902— 9,009 tons	1907—304,864 tons
1903—156,180 tons	1908— 57,194 tons
1904—120,697 tons	1909—201,480 tons
1905—185,944 tons	1910—232,582 tons
1906—268,281 tons	

Total, Tons1,536,231

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Albany:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
58.20	.074	6.04	.88	2.44	.21	.23	.010	6.55

Crete:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.35	.057	5.47	.44	1.03	.20	.24	.007	7.55

The Ore in its natural state is as follows:

Albany:

Moist	Iron	Phos.	Silica
12.50	50.93	.065	5.28

Crete:

Moist	Iron	Phos.	Silica
11.80	52.35	.050	4.83

VICTORIA MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1906. The ore is soft, red, Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 167 feet.

The ore is shipped via The Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1906— 64,820 tons	1909—113,305 tons
1907— 90,090 tons	1910— 27,592 tons
1908— 21,310 tons	

Total, Tons317,117

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.48	.058	7.08	.87					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.70	54.61	.052	6.39

VIRGINIA MINE.

Location: St. Louis County, Minnesota, Section 30, Township 58, Range 17.

Description: First opened up in 1910. This mine ships two ores, VIRGINIA BESSEMER HEMATITE and VIRGINIA NON-BESSEMER HEMATITE. Open pit system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1910—299,046 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Virginia Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.10	.037	8.84	.98	1.72	.41	.43	.345	5.19

Virginia Non-Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.90	.066	8.55	1.30	2.48	.34	.51	.421	6.09

The Ore in its natural state is as follows:

Virginia Bessemer:

Moist	Iron	Phos.	Silica
12.00	50.25	.033	7.78

Virginia Non-Bessemer:

Moist	Iron	Phos.	Silica
12.00	49.19	.058	7.52

VIRGINIA MINE.

Location: St. Louis County, Minnesota, Sections 8 and 9, Township 58, Range 17.

Description: First opened up in 1893. The ore is a soft, Bessemer and Non-Bessemer Hematite, and goes into Groups 2, 3 and 7. Underground and open pit systems of mining are used. The greatest vertical depth is 341 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1893—	123,015 tons	1902—	5,131 tons
1894—	544,954 tons	1903—	5,866 tons
1895—	622,712 tons	1904—	5,395 tons
1896—	955,739 tons	1905—	402,224 tons
1897—	749,499 tons	1906—	5,674 tons
1898—	560,848 tons	1907—	1,015,717 tons
1899—	293,651 tons	1908—	661,329 tons
1900—	417,473 tons	1909—	1,843,450 tons
1901—	5,420 tons	1910—	985,163 tons

Total, Tons9,203,260

See Analysis of Groups Nos. 2, 3 and 7.

WACOOTAH MINE.

Location: St. Louis County, Minnesota, Sections 3 and 11, Township 58, Range 18 West.

Description: First opened up in 1906. The ore is a soft, brown, Non-Bessemer Hematite. Open pit system of mining is used. The ore is shipped via the Duluth, Messabe & Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1906—	6,766 tons	1909—	60,966 tons
1907—	158,692 tons	1910—	35,498 tons
1908—			

Total, Tons261,922

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
53.77	.057	9.37	.66	5.78	none	none	.412	5.20

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
10.83	49.95	.051	8.36

WEBB MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57, Range 20.

Description: First opened up in 1905. The ore is a reddish brown, semi-hard Bessemer and Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 220 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

This mine is owned by the Shenango Furnace Company.

Yearly Shipments:

1905—	71,235 tons	1908—	19,610 tons
1906—	165,604 tons	1909—	
1907—	113,334 tons	1910—	46,384 tons

Total, Tons416,167

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
55.00	.047	15.00	1.00					

Non-Bessemer:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.00	.100	7.00	1.00					

The Ore in its natural state is as follows:

Bessemer:

Moist	Iron	Phos.	Silica
12.00	48.40	.042	13.20

Non-Bessemer:

Moist	Iron	Phos.	Silica
14.00	49.02	.086	6.02

WHITESIDE MINE.

Location: St. Louis County, Minnesota, Section 15, Township 58, Range 19.

Description: First opened up in 1909-1910. This mine ships WILPEN ore, a brown, semi-hard, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 230 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is owned by the Shenango Furnace Company.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
57.00	.100	7.00	1.00					

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
14.00	49.02	.086	6.02

WILLIAMS MINE.

Location: St. Louis County, Minnesota, Section 2, Township 58, Range 16.

Description: First opened up in 1895. The ore is a soft, dark brown, Bessemer and Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 105 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The Thomas Furnace Co., Milwaukee, Wis.

Yearly Shipments:

1895—	3,046 tons	1903—	
1896—	11,249 tons	1904—	
1897—		1905—	
1898—		1906—	17,685 tons
1899—	12,357 tons	1907—	35,267 tons
1900—	18,238 tons	1908—	
1901—		1909—	
1902—			

Total, Tons97,842

WILLS MINE.

Location: St. Louis County, Minnesota, Sections 17 and 18. Township 58, Range 16.

Description: First opened up in 1902. The ore is a soft, red, Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 86 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1902—	12,158 tons	1907—	
1903—		1908—	
1904—		1909—	3,441 tons
1905—	4,550 tons	1910—	26,712 tons
1906—			

Total, Tons46,860

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.00	.062	12.95	1.92	1.70	.09	.36	.017	5.76

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
9.83	49.23	.056	11.80

WINIFRED MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1903. The ore is soft, reddish brown, Bessemer and Non-Bessemer Hematite and goes into Groups 2, 3, 5 and 7. Underground system of mining is used. The greatest vertical depth is 165 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1903—	39,179 tons	1907—	94,867 tons
1904—	81,686 tons	1908—	61,341 tons
1905—		1909—	84,614 tons
1906—	3,415 tons	1910—	67,686 tons

Total, Tons432,788

See Analysis of Groups Nos. 2, 3, 5 and 7.

YATES MINE.

Location: St. Louis County, Minnesota, Section 11, Township 58, Range 19.

Description: First opened up in 1904. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1904— 53,179 tons	1907—210,289 tons
1905— 58,174 tons	1908— 86,308 tons
1906—265,289 tons	1909— 5,362 tons
Total, Tons .....679,038	

YAWKEY MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17 West.

Description: First opened up in 1907. The ore is Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 137 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907— 15,453 tons	1909— 45,790 tons
1908— 84,446 tons	1910— 30,439 tons
Total, Tons .....176,128	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
54.60	.083	10.58	.82	2.23	.31	.19	.012	7.38

The Ore in its natural state is as follows:

Moist	Iron	Phos.	Silica
13.80	47.07	.072	9.12

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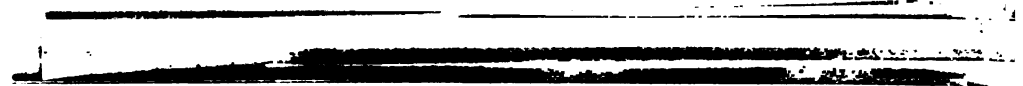
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